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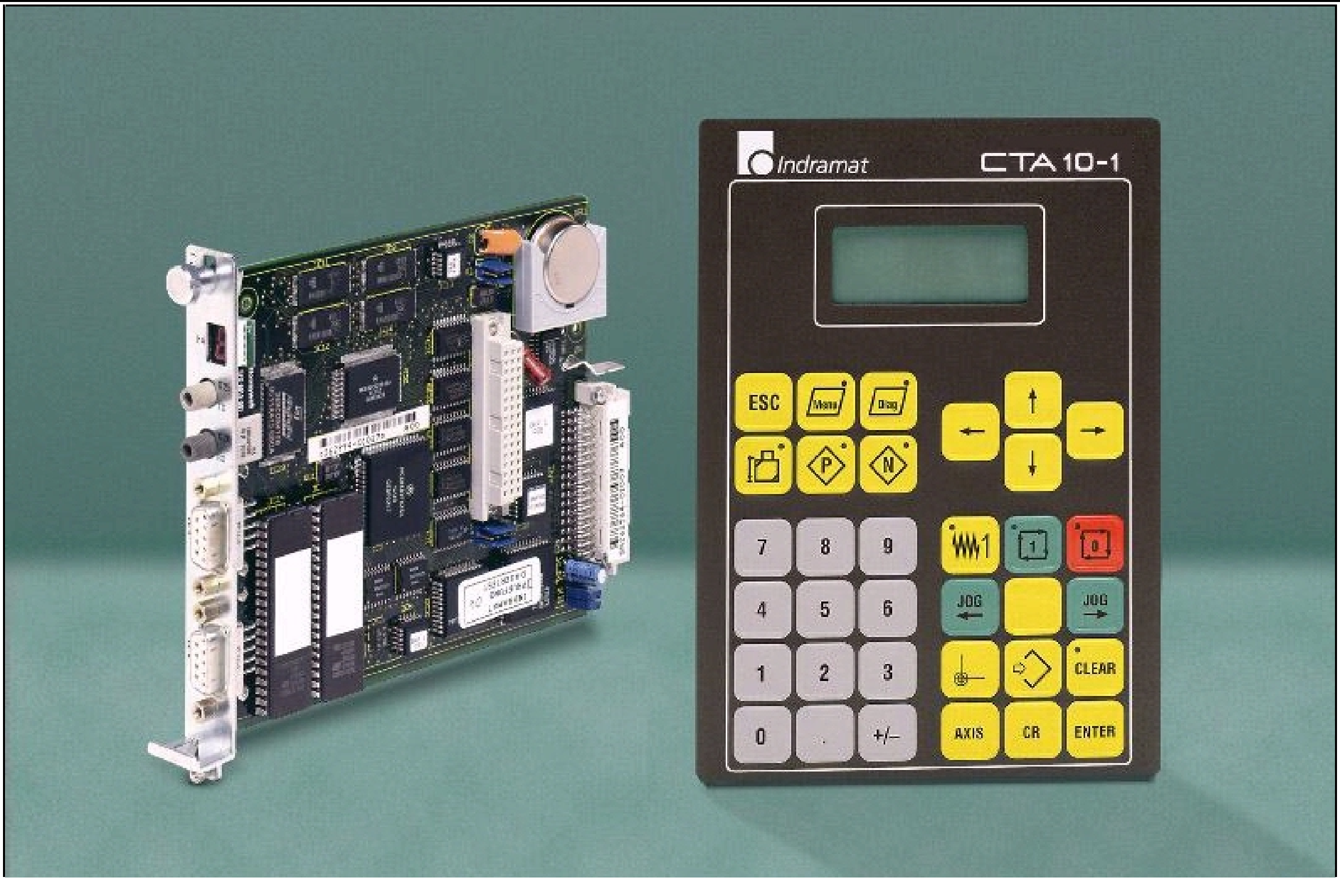

TRANS 01-D Motion Control System
for Indramat DIAX Digital Drive Families
Version 06VRS

User Manual

DOK-CONTRL-TRANS01D*06-AW02-AE-P

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Title

TRANS 01-D Motion Control System
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Version 06VRS

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Purpose of Documentation

This documentation familiarizes the user with the features and capabilities of the TRANS 01-D

Record of Revisions

Description	Release Date	Notes
01	6/98	New release for Version 6
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Rexroth Indramat Division • 5150 Prairie Stone Parkway • Hoffman Estates, IL 60192 • USA • Tel.: 847-645-3600 • Fax: 847-645-6201

http://www.rexroth.com/indramat

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Table of Contents

1 Introduction

1.1 TRANS 01-D Control

The TRANS 01-D is an open-architecture transfer-line station control modeled from the widely used "blue box" TRANS-01 with regards to programming and performance. It incorporates a 32-bit microprocessor and Realtime software. It installs as a plug-in module into Indramat's DIAX digital drive series and the CCD stand alone box.

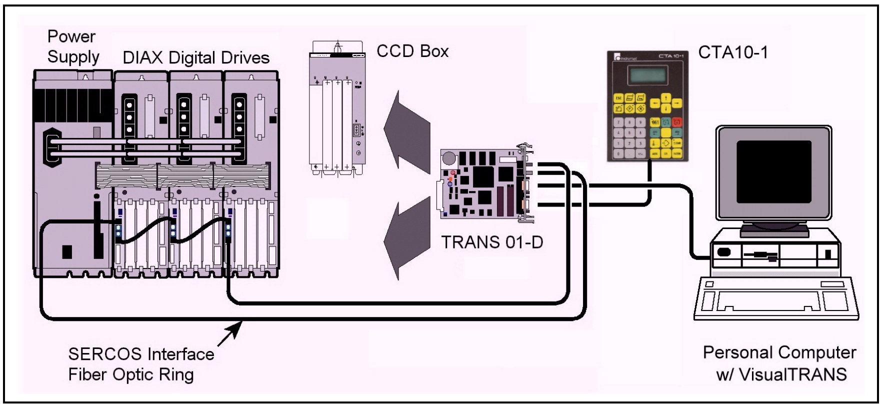

Figure 1-1: TRANS 01-D Hardware Interfaces

- The TRANS 01-D provides seamless integration of control and drive. It is designed specifically for demanding high-production applications such as Transfer Line Station Control, Dial Machines, Metal Cutting, and Robotics.
- The TRANS 01-D contains turnkey software for high-production applications. System setup uses interactive dialogs for entry of high-production-specific functions and parameters. System implementation and program changes do not require a computer programmer or a sophisticated programming language.
- With easy-to-use keyboard icons and menu-driven screen prompts, the TRANS 01-D allows the user to program and operate every high-production line in the same manner, regardless of machine manufacturer.
- Drive and control problems are automatically diagnosed by the TRANS 01-D, with messages displayed in plain English (as well as other selectable language).

With its considerable intelligence, the TRANS 01-D requires only task-oriented I/O commands from a supervisory line controller, such as a PLC, PC or flowchart-oriented control. It uses the international standard **SE**rial **R**ealtime **CO**mmunication **S**ystem (SERCOS) digital fiber-optic interface for digital drive control, and communicates to other devices via discrete I/O (DEA) and/or standard I/O buses such as Interbus-S (DBS3.X), Profibus and DeviceNet (products under development).

Single and Multi-Axis Coordinated Motion

Providing full contouring control of up to three axes plus a spindle, the TRANS 01-D is capable of multi-axis operations with built-in math routines for providing linear interpolation.

Axis configuration can consist of up to:

3 linear servo axes plus 1 spindle axis, or

2 linear servo axes, 1 rotary servo axis plus 1 spindle axis.

Simplified stand-alone programming

TRANS 01-D programming is direct and action-oriented. Using either a CTA10-1 or a BTC06, the user enters a program using interactive dialogs that present choices and request information about each selected action. Each block requests all information needed to complete the selected actions. No complex programming language, no difficult-to-remember mnemonics, and no additional programming hardware is required. The user simply chooses a desired action, and enters appropriate data as requested by the menus. The TRANS 01-D provides up to 200 program blocks.

1.2 HMI (Human/Machine Interface) Options

Indramat offers several optional HMI interfaces for communications and diagnostics of the TRANS 01-D.

CTA10-1

Indramat's CTA10-1 connects to the TRANS 01-D through a single serial communication cable. It's remote/keyboard terminal can provide a complete configuration, programming and operational interface for the TRANS 01-D. A four-line, 16 character per line alphanumeric display provides complete system status and diagnostics. The display permits single-key menu item selection during configuration and programming.

VisualTRANS software using industry standard G & M Code

Indramat's VisualTRANS is a Windows®-based software package which allows a TRANS-01D program to be developed off-line in a Personal Computer. VisualTRANS can be used in on-line mode to enter parameters and to upload/download parameter sets and programs, communicating with the TRANS 01-D via a serial communication cable.

BTC06 Mobile Handheld Terminal

Indramat's BTC06 is a mobile handheld terminal that allows the user to communicate with the TRANS 01-D in the same way as with the CTA10-1. The BTC06 offers mobility and quick access of programs and diagnostics to the user from station to station via the serial communication port located on the front of the TRANS 01-D.

Refer to Chapter 2, HMI Interfaces, for a complete description of the mentioned interfaces.

1.3 Serial Communication

The TRANS 01-D is equipped with two RS-232/RS-485 serial ports. One port is typically used with the system HMI, such as Indramat's CTA10 control terminal. The second port is available to the machine builder.

A serial port may be used to link multiple TRANS 01-Ds via RS485, to communicate with auxiliary equipment (e.g., gauging subsystem, etc.), or for communication with a host system such as a personal computer used for parameter and program upload/download. Commands and data are exchanged in a simple ASCII line format, allowing easy exchange with virtually any external system.

1.4 Operating Modes

The TRANS 01-D's multiple operating modes allow fully independent or fully automatic operation of station features. These additional modes permit local operation, setup and troubleshooting of a station. Operation can be completely independent of the executive controller.

Automatic program

- Program execution begins on command from the executive controller. When done, a completion signal can be sent to the executive control.

Manual program

- Continuous cycle – The complete NC part program executes repeatedly, ignoring programmed stops.
- Single cycle – The complete NC part program executes once and stops.
- Single block – Only the next program block is executed for each start command (momentary pushbutton).
- Manual – While a Forward or Reverse input line is held high, the appropriate forward or reverse program executes as in Automatic mode.

Hand operation

- Jog – Each axis may be moved individually.
- *Home – All axes move to a programmed home position*. (This function is currently not implemented.)

1.5 Operational Features

- Feed-to-positive stop (with automatic drive-current reduction).
- Spindle speed directly programmable in rpm.
- Adaptive-depth function uses a second encoder input to adjust axis position on the fly.
- Nine programmable tool correction offset registers per axis.
- Tool correction register values may be downloaded from an external gauging/measurement system.
- Ratio reduction function provides user definable units per revolution (e.g., rotary table drive).
- Programmable machine-movement fault indication if motion exceeds threshold during power-off (in systems with absolute motor feedbacks).
- Priority interrupts – for jump on event, home, or emergency return.
- Individual outputs may be activated by programmed position values during motion or program block execution.
- Axis movements programmable as absolute or incremental values.

1.6 Status and Diagnostic Display

Via the SERCOS interface, the TRANS 01-D provides extensive control, drive and motor status and diagnostic information. Diagnostic messages are displayed in plain English (as well as other selectable languages).

For example, using the CTA10-1 display terminal, a TRANS 01-D system can display status information for:

- Axis position – actual and commanded values.
- Spindle position – actual and commanded values.
- Following error (with instantaneous capture).
- I/O status – actual and commanded values for:
    - conditional jump
    - system control lines
    - user-definable lines
- Feedrate – actual, commanded and override values.
- Spindle speed (rpm) – actual.
- Dwell time.
- Axis motor velocity.
- Individual program blocks.
- Parameter and configuration values.

1.7 Technical Specifications

Number of feed axes controlled	three
Number of spindle axes controlled	one
Dimensioning system	inch or metric (degree for rotary apps.)
Programming resolution	0.0001 inches; 0.001 mm
Maximum traverse	Limited by values in SERCOS parameters: S-0-0049 Positive position limit value S-0-0050 Negative position limit value
Feedrate	programmable
Rapid traverse rate	programmable (parameter Aa10)
Jogging	Forward/reverse
Number of program blocks	up to 200
Programmed tool correction	9 registers per axis
External tool correction	1 register per axis
Dwell time	programmable from 0.01 to 99.99 sec
Auxiliary function outputs	
w/ DEA 4.X/5.X discrete I/O card	11 individually programmable on/off
w/ DEA28.X discrete I/O card	11 individually programmable on/off
w/ DBS (Interbus-S I) I/O config	7 individually programmable on/off
w/ DBS (Interbus-S II) I/O config	11 individually programmable on/off

1.8 Purpose of Manual

This is the user's manual for the Indramat TRANS 01-D motion controller. In addition to this introductory chapter, it contains the following six chapters.

- Chapter 1: Introduction of TRANS 01-D
- Chapter 2: HMI (Human Machine Interface) - describes the various interfaces used to communicate and program the TRANS 01-D.
- Chapter 3: Parameters - describes each parameter and the various methods that may be used to modify them.
- Chapter 4: Programming - describes the available G-code functions and the required formats for other program functionality, and provides examples of programming with the CTA10-1.
- Chapter 5: I/O Functional Description - covers the available interfaces to the machine builder's equipment, and the power interrupt handling features of the TRANS 01-D.
- Chapter 6: Diagnostics and Monitoring – describes the various status messages and other diagnostic messages available on the TRANS 01-D.

Four appendices are also provided for:

- Appendix A: CLC DDE Server
- Appendix B: Direct ASCII Communication
- Appendix C: Interbus-S I/O
- Appendix D: Engineering drawings

2 Interfaces to the TRANS 01-D

2.1 Human-Machine Interfaces (HMIs)

Indramat offers two Human-Machine Interface (HMI) options for the TRANS 01-D:

CTA10-1– An interface mounted outside the system cabinet.

BTC06– A portable, hand-held interface.

These HMIs can be used to view diagnostic messages, set parameters and perform basic programming for the TRANS 01-D.

Performing Tasks with the HMI

Though not a substitute for a PC, an HMI provides a convenient means to perform the following tasks:

- set operating mode under manual control
- select a connected axis for monitoring and control
- start and stop program cycle under manual control
- monitor actual position, following error, and velocity of the selected axis
- jog an axis under manual control
- view current diagnostic messages for the selected axis
- view or edit parameter values
- view or edit current program

Once the TRANS 01-D has been set up and a program installed, the operation of the control can be done via I/O inputs through the DEA card. It is then possible to disconnect the HMI and connect it to another TRANS 01-D without disrupting the operation of the first TRANS 01-D.

CTA10-1 (Recommended)

The CTA10-1 is a human-machine interface that connects to the TRANS 01-D's RS232/RS485 port. A dimensional diagram for the CTA10-1 and a wiring diagram for the connecting cable are in Appendix D. The CTA10-1 unit requires a 24Vdc supply, and is designed to be a dedicated operator panel mounted outside the system cabinet.

Hardware Features

- front panel with 33 functional membrane pushbuttons
- 4x16 character back-lit LCD
- IP65 rated (front), and IP30 rated (back) housing
- serial interfacing with RS232 and RS485 (the TRANS 01-D firmware supports only the RS232 serial interface)

Display

The TRANS 01-D can be operated using the keypad of the CTA10-1.

Figure 2-1 shows the front of the CTA10-1 keypad. The “Home” key is currently not used, and is marked with the ⊘ sign.

Figure 2-1: CTA10-1 Keypad

BTC06 Mobile Handheld Terminal

The BTC06 is a handheld portable HMI which can be connected to any TRANS 01-D hardware setup.

Hardware Features

- front panel with 48 membrane pushbuttons
- 240x128 pixel LC-graphic-display with LED background lighting
- ergonomic housing, IP65 rated
- serial interfacing with RS485 and RS422 (only RS-422 communication is supported with the TRANS 01-D)
- RS232 programming interface (only used for loading the BTC application software into FLASH ROM)

Display

Figure 2-2 shows the front of the BTC06 Handheld Terminal. The keypad contains some keys that are currently not used. These keys are marked with the ⊘ sign. Most of the functional keys parallel those of the CTA10-1.

Figure 2-2: BTC06 Handheld Terminal

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CTA10-1 and BTC06 Key Functions

Table 2-1 lists the CTA10-1 and BTC06 keys and their functions.

CTA10-1 Key	BTC06 Key	Function	CTA10-1 Key	BTC06 Key	Function
ESC		The <ESC> key clears any data in a numerical field, or backs up to the previous menu.	0	0	In Auto mode, the <Stop> key's LED is lit when the cycle has been stopped. In Manual mode, this key stops the cycle.
Menu	MENU	In Auto mode, the <Menu> key is disabled. In Manual mode, this key allows selection of one of six operating modes, Hand, Continuous, Single Block, Single Cycle, Set Absolute MP and CTA 10/BTC06 ON.	JOG	JO G	In Auto mode, both the forward and reverse<Jog> keys are disabled. In Manual mode, both of these keys can be used to jog the selected axis.
Diag	DIAG	The <Diag> key displays messages indicating any current diagnostic condition. The arrow keys are used to scroll between System-level, Axis-level, Task A and Task C diagnostics.		N/A	On the CTA10-1, the <Blank> key returns the display to the Axis Display screen.
		In Auto mode, the <Tool Offset> key allows viewing of tool correction values. In Manual mode, this key allows the user to enter tool correction values.			The <Save> key saves the current program block.
P	P	In Auto mode, the <P> key is disabled. In Manual mode, this key accesses a short list of parameters for editing.	CLEAR	CLEAR	The <CLEAR> key's LED is lit to indicate an error has occurred. This key should be pressed to attempt to clear the error. **BTC06** Display versions key sequence: <ESC>+<CLEAR>
N	N	In Auto mode, the <N> key allows review of the currently executing program block. In Manual mode, this key allows review or editing of the current program, block by block.	AXIS	AXIS	The <Axis> key is used to select the axis or axes to be displayed.
		Within menus, the up/down arrow keys are used to scroll up or down through the selections. All four arrows are used to navigate through the discrete I/O configuration screens (accessible from the Axis Display Screen.)	CR		**CTA10-1** Re-initialization key sequence: <ESC>+<CR> **BTC06** Display versions key sequence: <ESC>+<CLEAR> **CTA10-1** Access to Text Window for Serial Port Messages: <CR>+<Menu>.
		In Manual mode, the <Rapid Jog> key's LED is lit to indicate that the axis can be jogged at its rapid jog speed. This key is only enabled after the axis has been homed. In Auto mode, this key is disabled.	ENTER	O K	In menus, press this key to select the blinking option. When editing parameter or tool correction values, press this key to load the new value. When editing a program, press this key load the data and move the cursor.
1		In Manual mode, the <Start> key starts the cycle. In Auto mode, this key is disabled. In both modes, this key's LED is lit to indicate a program is running.			

Table 2-1. CTA10-1 and BTC06 Key Functions

CTA10-1 and BTC06 Screen Maps

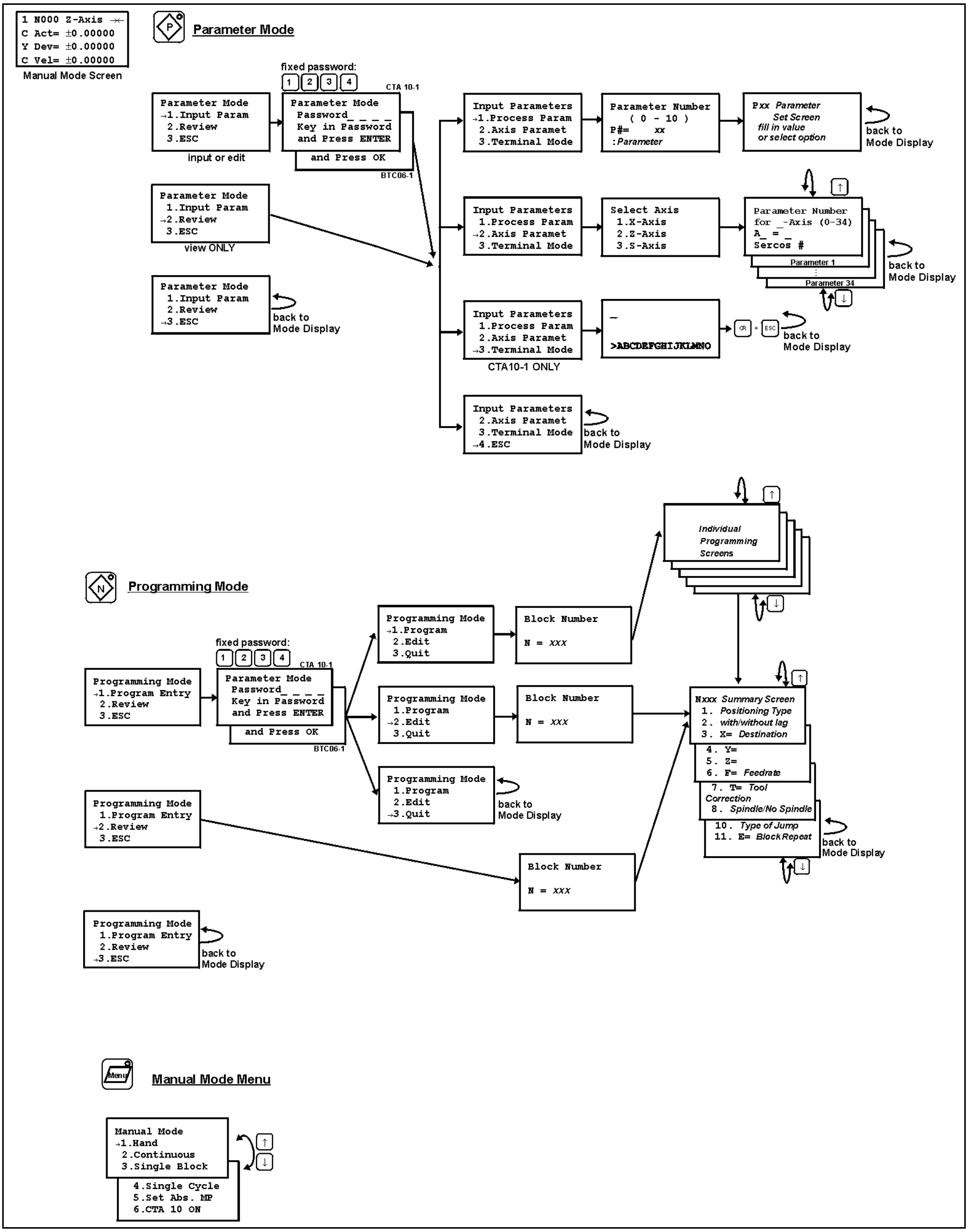

Figure 2-3: Displays Accessible Only from Manual Mode

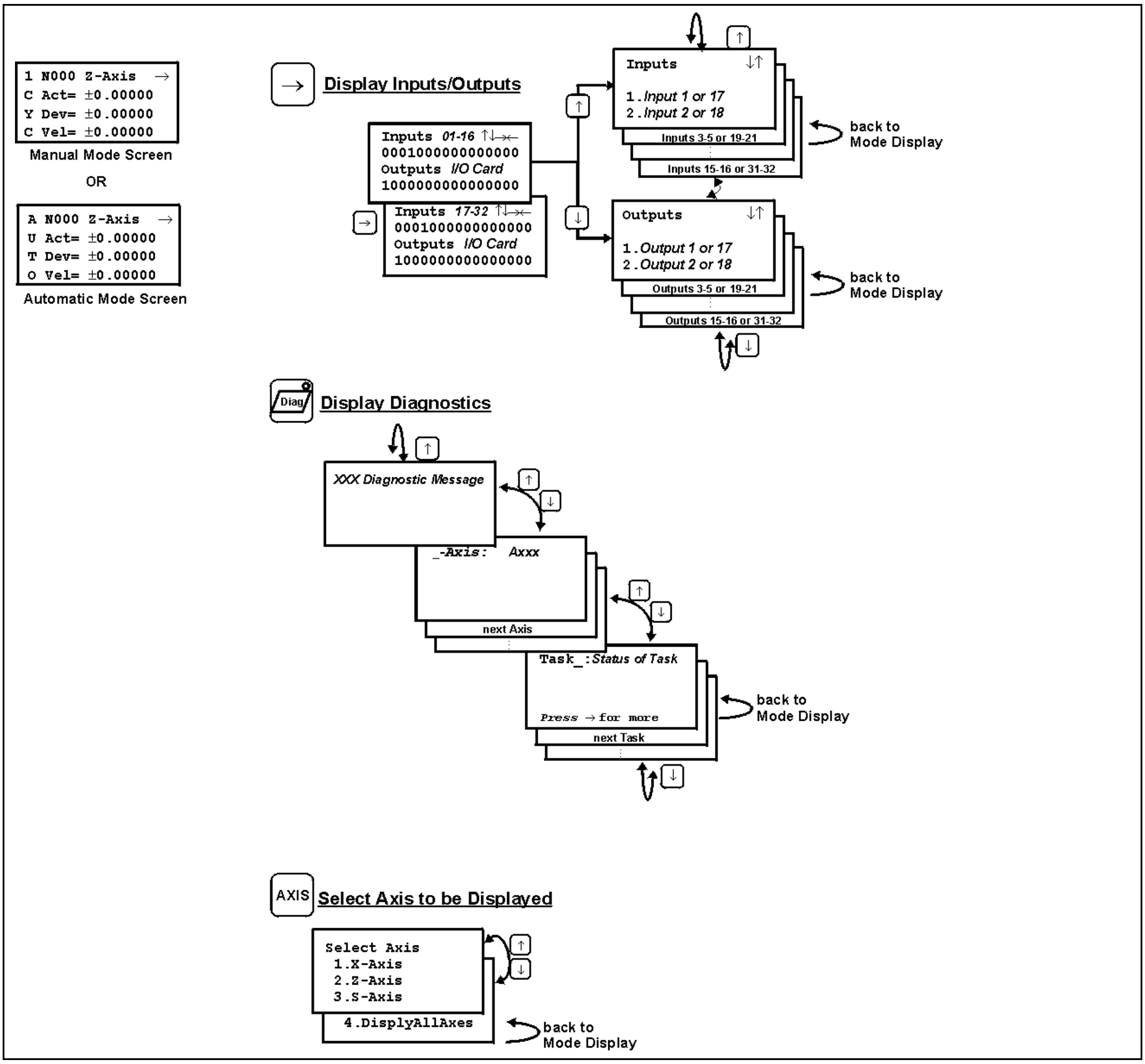

Figure 2-4: Displays Accessible from Automatic or Manual Mode

2.2 The VisualTRANS Interface

VisualTRANS is a software program that allows the TRANS 01-D to be programmed off-line from a PC through screen prompts within a Microsoft® Windows™ environment. VisualTRANS also allows saving, and editing any of the 200 Program Blocks (N000 - N199), which can include jumps from a current Program Block to any of the other 199 Program Blocks.

Following is the main screen of the VisualTRANS:

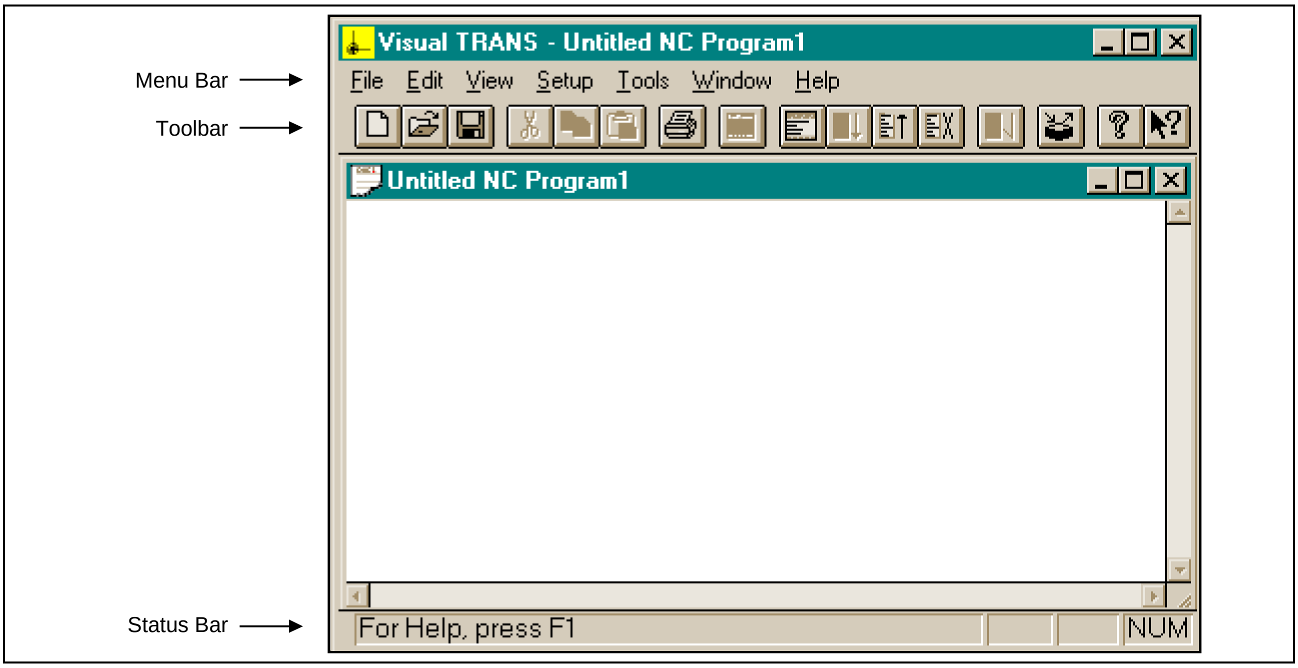

Figure 2-5: VisualTRANS Main Screen

Tool Bar

Located below the Menu Bar, the Tool Bar contains the following icons:

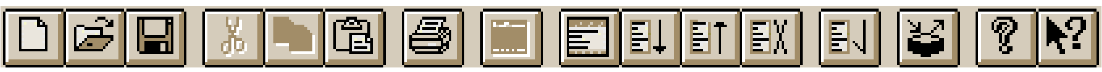

Figure 2-6: VisualTRANS Tool Bar

Those icons which control functions unique to the VisualTRANS program are described in this section.

Program Assistant

Step-by-step method available to aid with creating TRANS 01-D programming.

Download Data

Sends information from the PC based VisualTRANS to the TRANS 01-D.

Upload Data

Retrieves information from the TRANS 01-D and copies it to the VisualTRANS on a PC.

Delete Data

Deletes the current program in the TRANS 01-D.

Once cleared, the TRANS 01-D program <u>cannot</u> be recovered.

Check Syntax

Checks a Program Block or Parts Program for syntax errors to verify that input coding is properly formatted with valid codes that will be accepted by the TRANS 01-D.

Archive

Archives CLC Parameters.

VisualTRANS Information

Displays the copyright notice and version number of your copy of VisualTRANS.

Help

Calls up help on some portion of VisualTRANS. When you choose the Toolbar's Context Help button, the mouse pointer will change to an arrow and question mark. Then click somewhere in the VisualTRANS window, such as another Toolbar button. The Help topic will be shown for the item you clicked.

3 Parameters

3.1 Introduction

The parameters of the TRANS 01-D are accessible via the CTA10-1 interface panel as well as other interfaces. These interfaces are used to display the parameters for editing and programming. Although this chapter's parameter description is primarily geared around the CTA10-1 interface, the following is a list of the other interfaces that can communicate with the TRANS 01-D.

- BTC06 - mobile handheld interface
- VisualTRANS - Windows®-based program
- Serial Communication Protocol

Refer to Chapter 2, HMI (Human/Machine Interface) Options, for a description of each Interface.

The TRANS 01-D must be in Parameter Mode before editing parameter values. Many of the parameters that are entered are used for internal calculations and are also used to set other parameter values during re-initialization. Re-initialization is a process when the TRANS 01-D switches from phase 2 (Parameter mode) to phase 4 (ready for operation). Therefore, please consult the descriptions in this chapter to determine what parameters are written during re-initialization. **All range values given in this chapter are relevant to the CTA10-1.**

CTA10-1

The CTA10-1 displays the TRANS 01-D parameters as **three** (3) different sets. These parameter sets are called **Process (P), Axis (A) and Spindle (S).** The purpose of these divisions is to enable the user to easily configure their unit with the least amount of keystrokes.

Switching to Parameter Mode

To switch the CTA10-1 to parameter mode, press <P> from any screen. The CTA10-1 can only be switched to parameter mode if the machine is not running in automatic mode and the CTA10-1 is enabled

```
Parameter Mode
→1.Input Param
  2.Review
  3.ESC
```

```
Parameter Mode
  Password ____
Key in Password
and Press ENTER
```

From this screen, select "1. Input Param" by pressing ENTER, then enter the password "(1234)". This process will switch the drives from (AF) a drive ready condition to a P2 (parameter mode) condition.

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```
Input Parameters
→1.Process Param
 2.Axis Paramet
 3.Terminal Mode
```

From the Input Parameter screen, you can select "1. Process Param", "2. Axis Parameters", or "3. Terminal Mode" by selecting the corresponding number on the keypad or using the up and down arrows followed by ENTER.

Process (P) Parameters

Process parameters are settings that are more process orientated in nature. This group also includes parameters that will be used to enable different axes, various functions, and I/O configurations. When the different functions are enabled in this parameter set, this causes those parameters specific to that function to be displayed in the other sets. If a function is not enabled in the P set, its relative parameters will not be displayed. This is done so the programmer does not have to contend with parameters that are not relevant to his process. If a programmer does not see the necessary parameters for his process, he knows that he has not enabled that function in the P parameter set. Once process parameters are selected, enter the number of the desired parameter using the numeric keypad or the up and down arrows to scroll through the available parameters, then press ENTER to view that specific parameter.

```
Parameter Number
     (0-10)
 P#=     0
:Trans #
```

Process Parameters (P)			
Number	**Description**	**Selections and/or Range**	**Reference Page**
P00	TRANS 01-D Number	Select (0-31)	3-13
P01	TRANS Group Number	Select (0-10)	3-14
P02	Axis Configuration	X, Y, Z, S	3-15
P03	Auxiliary Outputs at Emergency Stop		3-17
P04	Auxiliary Outputs at Immediate Stop		3-18
P05	Automatic / Manual Switching	1. End of Cycle 2. Immediate	3-19
P06	System Options	1. Spindle Position (Enable / Disable) 2. Manual Mode Ready (Enable / Disable)	3-20
P07	Language	1. German 2. English 3. French	3-21
P08	Maximum Path Speed	inches, metric, degrees	3-22
P09	Maximum Path Acceleration	inches, metric, degrees	3-23
P10	Transfer Enable	a Axis *(a = X, Y, Z)* Max. Min.	3-24

Table 3-1: Process (P) Parameters table

Select Axis screen

Once axis parameters are selected, choose a servo (X, Y, Z) axis or a spindle (S) axis. For a Multi-axis setup of the TRANS 01-D, all three servo axes and the spindle parameter sets are displayed.

Note: Only those axis parameters that were configured in process parameter P02, Axis Configuration, will be displayed. Possible configurations can have up to:

3 linear servo axes plus 1 spindle axis, or

2 linear servo axes, 1 rotary servo axis plus 1 spindle axis.

```
Select Axis
→1.X-Axis
 2.Y-Axis
 3.Z-Axis
```

```
Parameter Number
For X-Axis(0-34)
 AX#=    0
:Sercos #
```

Axis (A) Parameters

The servo axis (A) parameters are those parameters that are specific to each servo axis. The information entered here is sent to the TRANS 01-D and the digital drive during re-initialization. Using these parameters, the programmer will be able to configure the TRANS 01-D to his specific application. Any options that are drive specific (such as encoder options, operating modes, special functions, etc.) are handled here. After selecting an axis, enter the number of the desired parameter using the numeric keypad or the up and down arrows to scroll through the available parameters, then press ENTER to view that specific parameter. The numbering convention for servo axis parameters is:

A**a**00

- 00: Parameter number
- **"a"** denotes the (X, Y, or Z) axis designation
- A: Axis parameter

Axis Parameters (A)			
Number (a = X,Y,Z)	**Description**	**Selections and/or Range**	**Reference Page**
Aa00	Parameter Set		3-26
Aa01	Special Functions Enables	1. Feed to Positive Stop	3-27
		2. Adaptive Depth	3-28
		3. Home Switch Monitoring	3-29
Aa02	Units	1. Inches	3-30
		2. Millimeters	
		3. RPM	
		4. Units / Rev.	
Aa03	Feed Constant		3-32
Aa04	Positioning Feedback Type	1. Motor Encoder	3-33
		2. Linear Scale	3-34
		3. External Rotary Encoder	3-35
Aa05	Gear Ratio	Revs In : Revs Out	3-37

Axis Parameters (A)			
Number (a = X,Y,Z)	**Description**	**Selections and/or Range**	**Reference Page**
Aa06	Overtravel Limits	1. + Limit 2. - Limit	3-38
Aa07	Bipolar Torque Limit	Enter in %	3-39
Aa08	Axis Gains	1. Set Gains 2. Load Default	3-40
Aa09	Ramp		3-41
Aa10	Speeds	Homing, Maximum, Slow Jog, Rapid Jog	3-42
Aa11	Directions	Program, Jogging, Homing	3-44
Aa12	Homing Reference	1. Switch / Marker Pulse 2. Switch 3. Marker Pulse 4. To Positive Stop	3-45
Aa13	Reference Position		3-46
Aa14	Overload Factor	Controlled by Digital Drive	3-47
Aa15	Maximum Tool Correction	0 - 3 (UM)	3-49
Aa16	Axis AF Switching	1. Disable 2. Enable	3-50
Aa17	Control Windows	Position Window Monitoring Window Zero Velocity Window	3-51 3-51 3-51
Aa18	External Encoder Control Window		3-52
Aa19	Deactivate Absolute Encoder Function	0 - Disable 1 - Enable	3-53
Aa20	Maximum Speed to Positive Stop	0 - System Maximum	3-54
Aa21	Positive Stop Torque %	To Stop: 0 - 400 % At Stop: 0 - 400 %	3-55
Aa22	Home to Stop Distance	0 - travel limits maximum	3-56
Aa30	Maximum Speed for Adaptive Depth	0 - limit in Aa10	3-57
Aa31	Linear Encoder Pre-Limit	0 - 2 inches or 50 mm	3-58
Aa32	Linear Encoder Maximum Deflection	0 - 2 inches or 50 mm	3-59
Aa33	Linear Encoder Resolution	0 - 21474	3-60
Aa34	Linear Encoder Direction	0 - Positive 1 - Negative	3-61

Table 3-2: Axis (A) Parameters table

```
Select Axis
 2.Y-Axis
 3.Z-Axis
→4.S-Axis
```

Spindle (S) Parameters for DIAX01 Digital Drives

Unlike the servo axis parameters, the spindle parameters displayed on the CTA10-1 are dependent upon the type of DIAX drive that is connected. The TRANS 01-D can determine which type of digital drive is connected as a spindle drive and display the corresponding set of spindle parameters. The following table contains the drive firmware compatibility for the spindle axis.

Drive Type		Drive Firmware
DIAX01	(TDA, KDA, RAC)	Standard Firmware
DIAX02	(DDS2.1, DDS3.1, DDC)	SSE 02V07 or higher
DIAX03/04	(DDS2.2, DDS3.2, DKR)	SHS 02V16 or higher

Table 3-3: Drive firmware compatibility

For DIAX01 Spindle drives (TDA, KDA or RAC), the following screens appear when the S-Axis parameters are selected.

```
DIAX01 Spd Param
1.P-set
2.Q-set
3.R-set
```

```
Sx00 Select
4.S-set
5.General Param
6.Motor Param
```

From these screens, the desired parameter set is selected. Using these parameters, the programmer will be able to configure the TRANS 01-D to his specific spindle application. Any options that are drive specific (such as positioning speeds, gear ratio, ramp settings, etc.) are handled here. After selecting the desired parameter set, use the ENTER key to navigate through each parameter or the ESC key to return to the previous parameter. Refer to Spindle Parameters on page 3-62 for a complete description of each parameter used with DIAX01 digital drives. The numbering convention for DIAX01 spindle axis parameters is:

S**x**00

- 00 — Parameter number
- x — **P, Q, R, S** = User Selectable Parameters; **A** = General Parameters; **M** = Motor Parameters
- S — Spindle designation

Spindle Parameters used with DIAX01 Drives			
Number	**Description**	**Selections and/or Range**	**Reference Page**
SP1	Positioning Speeds	Spindle Search	3-64
SP2	Control Windows	Position: 0.1 - 359.9° Monitor 0 - 169.9 %	3-65
SP3	KV Factor	0.1 - 29	3-66
SP4	Bipolar Velocity Limit	0 - 10,000 rpm	3-67
SP5	Gear Ratio	Input REV: 1 - 9999 rpm Output REV:1 - 9999 rpm	3-68
SP6	Thresholds	Torque: 1 - 100 % Power: 1000 - 127,000 W	3-69
SP7	Ramp - RPM1	Ramp1: 0 - 999 rad/s² RPM1: 0 - 30,000 rpm	3-70
SP8	Ramp - RPM2	Ramp2: 0 - 999 rad/s² RPM2: 0 - 30,000 rpm	3-71
SP9	Ramp - RPM3	Ramp3: 0 - 999 rad/s² RPM3: 0 - 30,000 rpm	3-72
SP10	Gain 1	P-Gain 1: 0 - 9.99 I-Gain1: 0 - 9.99	3-73
SP11	Gain 2	P-Gain 2: 0 - 9.99 I-Gain2: 0 - 9.99	3-74
SP12	Gain RPM	0 - 30,000 rpm	3-75
SP13	POS-Gain	0 - 29	3-76
SP14	PQ-Functions	Bit 0: Special Positioning Bit 1: Spindle/Motor Direction Bit 2: I-Gain Active Bit 6: Position to Home Switch Bit 8: Power Failure Handling	3-77
SA1	Maximum Speed	Program: defaults from T01D Motor: 0 - 10,000 rpm	3-80
SA2	Zero Velocity Window	1 - 99 rpm	3-81
SA3	Velocity Window	1 - 99 rpm	3-82
SA4	Bipolar Torque Limit	1 - 100 %	3-83
SA5	Motor Overtemperature Warning	45 - 155°C *(Default: 145°C)*	3-84
SA6	Motor Overtemperature Shutdown	45 - 155°C *(Default: 145°C)*	3-85
SA7	Directions (Velocity / Positioning)	Velocity: 0 = CW, 1 = CCW Positioning: 0 = CW, 1 = CCW	3-86

Spindle Parameters used with DIAX01 Drives			
Number	**Description**	**Selections and/or Range**	**Reference Page**
SA8	Resolution of External Feedback	3 - 8192 lines per rev. (LPR)	3-87
SA9	Reference Offsets	Motor Fdbk: 0 - 359.9° Ext. Fdbk: 0 - 359.9° 2nd Motor: 0 - 359.9°	3-88
SA10	Motor Oscillation Settings	Speed: 1 - 200 rpm Of Speed: 1 - 200 rpm Cycle Time: 32 - 655504.0 ms	3-89
SA11	Function 1	Bit 0: Torque/Power Limiting Bit 3: Position to Ext. Feedback Bit 5: N-Output RPM or Bus Volt. Bit 6: N-Output Variable or Torque Bit 7: N-Output RPM or Mtr Temp.	3-90
SA12	Function 2	Bit 2: Motor Winding Switching Bit 5: Velocity Ramp for E-Stop Bit 6: RAC Chopper Active Bit 8: Bleeder Monitor or Torque Bit 10: Monitor Ext. Feedback	3-90
SM1	Feedback	Feedback type: 1 - 6 *(Default 1)* T-Filter: 0 - 3 *(Default 3)*	3-94
SM2	Poles / Slip Limit	Poles: 2 - 8 Slip Limit: 1 - 7.9	3-95
SM3	Flux / Current	Flux: 1 - 400 Current: 1 - 400	3-96
SM4	Sign	Slip: 0 - 414 Rpm: 500 - 30,000 rpm Volt: 0 - 999 Volt	3-97
SM5	Motor Functions (MOTFUNCT)	depends on motor/drive	3-98
SM10	Feedback	Feedback type: 1 - 6 *(Default 1)* T-Filter: 0 - 3 *(Default 3)*	3-98
SM11	Poles / Slip Limit	Poles: 2 - 8 Slip Limit: 1 - 7.9	3-100
SM12	Flux / Current	Flux: 1 - 400 Current: 1 - 400	3-101
SM13	Sign	Slip: 0 - 414 Rpm: 500 - 30,000 rpm Volt: 0 - 999 Volt	3-102
SM14	Motor Functions (MOTFUNCT)	depends on motor/drive	3-103

Table 3-4: Spindle (S) Parameters table for DIAX01 drives

Spindle (S) Parameters for DIAX02 Digital Drives

When using a DIAX02 digital drive as a spindle axis, the spindle parameters programmed in the TRANS 01-D are different from those used by DIAX01. The following screen appears when the S-Axis parameters are selected from the Select Axis screen on the CTA10-1.

```
DIAX2 Parameters
For S-Axis(0-13)
 AS#=   0
:Units
```

From this screen, the S-Axis parameters are selected. Using these parameters, the programmer will be able to configure the TRANS 01-D to his specific spindle application. Any options that are drive specific (such as positioning speeds, gear ratio, ramp settings, etc.) are handled here. Enter the number of the desired parameter using the numeric keypad or the up and down arrows to scroll through the available parameters, then press ENTER to view that specific parameter. Refer to Spindle Parameters on page 3-104 for a complete description of each parameter used with DIAX02/03/04 digital drives. The numbering convention for spindle axis parameters used with DIAX02/03/04 is:

AS00

Parameter number
S = denotes the (S) spindle axis designation
Axis parameter

Spindle (S) Parameters for DIAX03/04 Digital Drives

When using a DIAX03/04 digital drive as a spindle axis, the spindle parameters programmed in the TRANS 01-D are different from those used by DIAX01 but similar to those used with DIAX02 digital drives. The following screen appears when the S-Axis parameters are selected from the Select Axis screen on the CTA10-1.

```
Diax3/4 Parametr
For S-AxIs(0-13)
 AS#=    0
:Units
```

Spindle Axis Parameters (A) for DIAX02/03/04			
Number	**Description**	**Selections and/or Range**	**Reference Page**
AS00	Units	nnn.nnn	3-105
AS01	Positioning Feedback Type	1. Motor encoder 2. Linear Scale 3. External Rotary Encoder	3-106 3-107 3-108
AS02	Homing Reference	1. Switch / Marker Pulse 2. Switch 3. Marker Pulse 4. To Positive Stop	3-109
AS03	Positioning OFFSET	nnn.n	3-110
AS04	Gear Ratio	Revs In : Revs Out	3-111

Spindle Axis Parameters (A) for DIAX02/03/04			
Number	**Description**	**Selections and/or Range**	**Reference Page**
AS05	Bipolar Torque Limit	Enter in %	3-112
AS06	Axis Gains	1. Set Gains 2. Load Default	3-113
AS07	Ramp		3-114
AS08	Speed	Positioning Maximum	3-115
AS09	Directions	Velocity, Jogging	3-116
AS10	Overload Factor	Controlled by Digital Drive	3-117
AS11	Control Windows	Position Window Monitoring Window Zero Velocity Window	3-119
AS12	External Encoder Control Window		3-120

Table. 3-5: Spindle (S) Parameters List for DIAX02/03/04 Drives

Terminal Mode

Choice 3 under Parameter / Input Parameter is Terminal Mode. This allows for the direct entry of ASCII protocol commands at the CTA10-1. When the password is entered and Terminal Mode is chosen, the TRANS 01-D is put in Parameter Mode. But any command can be sent – not just parameter commands. These include program block commands, read and write variables, etc. This must be done with caution and only by authorized personnel. Refer to the “Direct ASCII Communication” appendix for more information on the ASCII protocol.

The Terminal Mode screen displays the “greater than” symbol (“>”), the letters A through Z, and the colon symbol (“:”) on the bottom line of the display since these characters are not available on the keyboard. To select one of these characters, press the Jog Right or Jog Left key to move the underline that marks the currently selected character. Once the desired character is underlined, press the Enter key to add that character to the string to be sent. The numeric keys (0 through 9, decimal, and minus sign) act normally for entering numbers.

The upper 3 lines of 16 characters display the command line as it will be sent.

The Left Cursor key is a backspace to delete the last character in the string. The Right Cursor adds a space at the end of the string.

Once the command is correctly displayed, press the Send Data key to transmit the entire string. The command string and the characters on the bottom row are cleared and the response is displayed. The response is either an acknowledgement or an error message.

For example, if the following string is entered,

“>SP SP BF SP 1.101 SP N101 SP G01 SP G90 SP G61 SP X1.23 SP F100”

The reply will be “>SP SP BF SP 1.101” if data is correctly entered and the block is valid for the way the TRANS 01-D is configured. The block will be stored and any previous data in N101 is permanently deleted.

The reply will be “>SP SP BF SP 1.101 SP !76 SP Invalid SP Block” if the data is not valid (for example, if there is no X axis configured).

Press the Enter key to clear the reply, display the letters and symbols on the bottom line, and prepare to enter the next command.

To exit terminal mode, hold the ESC key and press and release the Enter key. This reboots the CTA10-1 and returns it to its normal operating function. After it reinitializes and displays the Parameter mode menu, press the ESC key as required to exit Parameter mode.

Another example of use of terminal mode is to enter data for external tool correction from the CTA10-1 while debugging execution of a program containing an external tool correction T-code. To write the correction value from the example in Chapter 4, enter:

“>$_{SP}$ $_{SP}$FP$_{SP}$0.1$_{SP}$1.23”

It is not necessary to enter the checksum. The checksum calculation is done by the CTA10-1. The reply should be “>$_{SP}$ $_{SP}$FP$_{SP}$0.1”.

To set the handshake, write the command:

“>$_{SP}$ $_{SP}$GP$_{SP}$0.2$_{SP}$1”

The reply should be “>$_{SP}$ $_{SP}$GP$_{SP}$0.2”. Reboot the CTA10-1 and exit Parameter Mode. The values remain stored so that the next time a T01, T02, or T03 is encountered in the execution of a program, the value in the tool correction buffer will be transferred to the corresponding axis tool correction, the handshake will be reset to 0, and execution of the program will continue using the external correction value.

BTC06

Indramat's BTC06 is a mobile handheld terminal that allows the user to communicate with the TRANS 01-D in the same way as with the CTA10-1. The BTC06 offers mobility and quick access of programs and diagnostics to the user from station to station via the serial communication port located on the front of the TRANS 01-D.

Refer to Chapter 2, HMI Interfaces, for a complete description of the BTC06.

VisualTRANS

VisualTRANS is a Windows®-based utility that can be used for programming, monitoring and configuration of your TRANS 01-D system. For a complete description of the VisualTRANS software, please see the Indramat VisualTRANS Reference Manual.

The parameter sets that are accessible through VisualTRANS are structured differently than the set used with the CTA10-1. The set accessed with VisualTRANS is the SERCOS parameter set that all TRANS 01-D systems use. All parameters follow the SERCOS identification format:

- C-0-nnnn TRANS 01-D card parameter
- A-0-nnnn TRANS 01-D axis parameter; these numbers do not correspond exactly to those of the CTA10-1.
- T-0-nnnn TRANS 01-D task parameters; **Task C is the only valid task in the TRANS 01-D.**

VisualTRANS can only access the TRANS 01-D parameter sets when it is actively communicating to the TRANS 01-D. The parameters are divided into four (4) sets. These sets are:

- CLC Card Parameters (C set)
- Drive parameters (D set)
- Axis parameters (A set)
- Task parameters (T set).

To access the TRANS 01-D parameters, start the VisualTRANS program. On the main VisualTRANS screen, choose the “Setup” option on the menu bar. In the menu that drops down, choose “Drives”. This will take you to the ‘Drive Parameter Editor” screen. On the main menu bar on this

screen, choose "Parameters". On this drop down menu, choose "Overview". In the lower, left hand corner of the screen, you may choose the parameter set you wish to view/edit. In the sections that follow, the SERCOS designation for each parameter will be listed to aid you in finding specific parameters. Parameter ranges are displayed as you edit the values.

Serial Communication

The parameter labeling for this communication protocol is similar to that viewed using VisualTRANS. Only the syntax used to send/receive parameters is different. The complete description of the protocol used to upload and download parameter information to the TRANS 01-D is described in Appendix B. To summarize, all parameters accessed via Serial Protocol conform to the following format requirements:

- x a digit in the 16-bit word that should not be changed
- d SERCOS drive number
- a axis number (same as the drive number)
- CP TRANS 01-D card parameter
- AP TRANS 01-D axis parameter that resides on the CLC card; these numbers are not identical to those of the CTA10-1
- TP TRANS 01-D card task parameters; used for internal position interpolator (path planner).

To change the parameter values, the TRANS 01-D must be in Parameter Mode. To write data to many of the system parameters, you do not have to be in Parameter Mode, but it is recommended that you only edit parameter values in Parameter Mode to avoid any unexpected changes in other parameter values.

When using Serial Protocol, remember that the entire parameter value is written to the TRANS 01-D. If the parameter you are writing to is a Hex value (a set of 16 bits, 0000000000000000), you must send the complete bit pattern for the entire parameter. Neglecting to set other option bits may cause previous settings to be overwritten.

Ex: If the value in the parameter is 1000000000001011 and you want to change only the LSB from a 1 to a 0, you must send down 1000000000001010. If you send 0000000000000000, the value of the parameter will become 0000000000000000. If you send only 0, the TRANS 01-D will give you an "invalid data format" error.

When entering values for the P set in the servo drive, add 32768 to the P parameter number to obtain the correct number to use.

Ex: P-0-0006 + 32768 = 32774, Enter DP n.32774 to change the value of P-0-0006.

The following table will be used with each parameter to identify the naming convention of each User Interface parameter along with the allowable values when setting them.

	Access Method	Identification	Permissible Values
A.	CTA10-1 (BTC06-1)	Pxx	1 - 30
B.	VisualTRANS	C-x-xxxx	1 - 30
C.	Serial Protocol	CP x.x	1 - 30
D.			*Default: 0*

Table 3-1: Parameter Table Explained

A. Parameter Identification for both CTA10-1 and BTC06

B. Parameter Identification for Indramat's Windows®-based software program.

C. Parameter Identification identified by the TRANS 01-D as an external interface other than CTA10-1 and BTC06

D. Default value used if no parameter is set by the user.

3.2 Process Parameters

P00 TRANS 01-D Number

```
P00 Trans Number
   ( 0 - 31 )
Trans  #: nn
```

nn - Unique number for this TRANS 01-D on the network. An acceptable entry can be any number from 0 - 31

Access Method	Identification	Permissible Values
CTA10-1 or BTC06	P00	0 - 31
VisualTRANS	C-0-0002	0 - 31
Serial Protocol	CP 2.0	0 - 31
		Default: 0

When multiple TRANS 01-Ds are networked together using the RS485 communication link, each unit in the network must have a unique number to identify it. If the TRANS 01-Ds are not linked together, this parameter may be left at the default value of 0.

Enter the value to be used for this parameter. Press ENTER when all data is confirmed and the TRANS 01-D will store the data for this parameter and step to the next parameter.

Tip: If you make a mistake entering a value within this parameter, press the ESC key on the CTA10-1 and enter the correct value. However; if you realize that you entered an incorrect value after pressing ENTER and proceeding to the next parameter, use the down arrow to return to the previous parameter, press ENTER and correct any errors.

Note: For more information on using the RS485 communication link refer to the DDE Server appendix A.

P01 Trans Group Number

```
P01 Trans Group
Number (0-10)
Group #:nn
```

In development.

P02 Axis Configuration

```
P02 Axis Config.
Axis DSS# E  I/O
 X     01  n nnnn
 Y     02  n nnnn
```

```
P02 Axis Config.
Axis DSS# E  I/O
 Z     03  n nnnn
 S     04  n nnnn
```

DSS # - The rotary switch number on the SERCOS™ card plugged into the digital servo drive. This number designates the axis number on the TRANS 01-D fiber optic ring. This number cannot be changed here.

n - Enter a “1” to enable the axis. A “0” means the axis is disabled.

nnnn - Enter the I/O configuration to be used for this axis. See the table below for the available options.

Access Method	Identification	Permissible Values
CTA10-1 or BTC06-1	P02	**n**: 0 or 1 (disabled or enabled) **nnnn**: **0000** - No I/O configuration associated with this axis. **0001** - A DBS 3.x or DBS 4.x (Interbus-S I configuration) is installed for System I/O **0011** - Interbus-S II configuration **1000** - A DEA 4.x card is installed for System I/O **1100** - DEA 4.x & DEA 5.x cards are installed for System I/O. **0010** - DEA28 card is installed for System I/O
VisualTRANS	A-0-0300 NOTE: This parameter must be set for each axis in the system.	0x0011 (DBS 3 or 4 w/ config IBS I) 0x0013 (DBS 3 or 4 w/ config IBS II) 0x0018 (DEA4) 0x001C (DEA4 & DEA5) 0x0012 (DEA28) NOTE: A “1” in the second least significant nibble indicates that the axis is enabled, e.g., 0x0018 would indicate that the axis is enabled and has a DEA4 installed; 0x0008 would indicate that the axis is disabled and has a DEA4 installed
Serial Protocol	AP a.300	Same as above
		Defaults: *No axes enabled for release 06V48 and later. (Z axis was enabled as default prior to release 06V48.)* *Null I/O enabled for release 06T27and later. (Interbus-S I I/O configuration on Z axis was default prior to 06T27.)*

This parameter enables the axis in the system and tells the TRANS 01-D which I/O configuration will be used for the system.

The **DSS #** will be displayed by the CTA10-1 as a reference. To change the axis number on the fiber optic ring, the rotary switch (S2 Low) on the DSS card must be changed and then re-cycle power to the digital drive.

Refer to Aa00 Parameter Set, page 3-26 for a complete description on changing the axis number.

Enter a 1 under the column **E** for each axis you want to enable. Enter a 0 for each axis you want to disable. These designations follow the axis designations used for CNC type machines. If an axis that is not on the ring is enabled, the TRANS 01-D will issue an "Axis X not found on ring" error message. To correct this error, re-designate the axis correctly.

Note: No servo operation is possible with the S axis, nor can a servo axis (X, Y or Z) be designated as a spindle. You can, however, use a digital servo drive as a spindle drive if you configure the drives as follows:

1. DIAX02 digital drives using SSE firmware.
2. DIAX03/04 digital drives using SHS firmware only.

The TRANS 01-D has the option of using discrete I/O and/or handling I/O across the Interbus-S network. To use discrete I/O, the user can install an Indramat DEA 4.x and, if needed, a DEA 5.x I/O card into the digital drive or plug a DEA28.x card onto the TRANS 01-D. When this I/O configuration is used, the user must tell the digital drive which type of I/O card option is being used. To use the Interbus-S option, a DBS 3.x or DBS 4.x option card must be plugged into the TRANS 01-D and installed into the servo drive. The following table lists the options available. The number in the left column is entered into the I/O field in this parameter.

After this parameter has been entered, the TRANS 01-D must be reset (powered down and re-powered up) in order to initialize the changed I/O structure.

Enter the number to be used for this parameter. Press ENTER when all data is confirmed and the TRANS 01-D will store the data for this parameter and step to the next parameter.

Tip: If you make a mistake entering a value within this parameter, press the ESC key on the CTA10-1 and enter the correct value. However; if you realize that you entered an incorrect value after pressing ENTER and proceeding to the next parameter, use the down arrow to return to the previous parameter, press ENTER and correct any errors.

I/O Type	Auxiliary Outputs	Acknowledge Inputs	Conditional Jumps	CTA10-1, P02 Configuration
DEA 4	11	3	3	1000
DEA 4&5	11	7	5	1100
DEA 28	7	7	5	0010
IBS *I*	7	7	5	0001
IBS *II*	11	7	5	0011

Table 3-2: TRANS 01-D I/O options

P03 Auxiliary Outputs at Emergency Stop

```
P03 Auxiliary
Output at
Emergency Stop
nnnnnnn
```

n - Auxiliary Output status when an Emergency Stop occurs. A numerical value must be entered as follows: 0 (off), 1 (on), or 2 (unchanged).

Access Method	Identification	Permissible Values
CTA10-1 or BTC06-1	P03	for each of the seven Auxiliary Function outputs: n = 0 (off) n = 1 (on) n = 2 (unchanged)
VisualTRANS	C-0-0300	2222222 (Interbus S I) 22222222222 (Interbus S II) 22222222222 (DEA I/O)
Serial Protocol	CP x.300	Same as above
		Default: unchanged (for all outputs)

In the event of an Emergency Stop, it may be necessary to re-configure the Auxiliary Outputs in order to safely or more easily recover from the fault. This parameter gives the user that ability.

The number of outputs available is dependent on the I/O configuration programmed in P02 Axis Enable. When Interbus-S configuration I is selected, the user has seven (7) outputs available. When Interbus-S configuration II, DEA 4.x or DEA4.x/DEA 5.x cards are used, the user has eleven (11) outputs available. Refer to Table 3-2: TRANS 01-D I/O options for more information.

The TRANS 01-D recognizes an Emergency Stop as when the Emergency Stop input on the DSS card goes low.

Enter the value to be used for this parameter. Press ENTER when all data is confirmed and the TRANS 01-D will store the data for this parameter and step to the next parameter.

Tip: If you make a mistake entering a value within this parameter, press the ESC key on the CTA10-1 and enter the correct value. However; if you realize that you entered an incorrect value after pressing ENTER and proceeding to the next parameter, use the down arrow to return to the previous parameter, press ENTER and correct any errors.

P04 Auxiliary Outputs at Immediate Stop

```
P03 Auxiliary
Output at
Immediate Stop
nnnnnnn
```

n - Auxiliary Output status when an Immediate Stop occurs. A numerical value must be entered as follows: 0 (off), 1 (on), or 2 (unchanged).

Access Method	Identification	Permissible Values
CTA10-1 or BTC06-1	P04	for each of the seven Auxiliary Function outputs: n = 0 (off) n = 1 (on) n = 2 (unchanged)
VisualTRANS	C-0-0301	2222222 (Interbus S I) 22222222222 (Interbus S II) 22222222222 (DEA I/O)
Serial Protocol	CP x.301	Same as above
		Default: unchanged (for all outputs)

In the event of an Immediate Stop, it may be necessary to re-configure the Auxiliary Outputs in order to safely or more easily recover from the situation. This parameter gives the user that ability.

The number of outputs available is dependent on the I/O configuration programmed in P02 Axis Enable. When Interbus-S configuration I is selected, the user has seven (7) outputs available. When Interbus-S configuration II, DEA 4.x or DEA4.x/DEA 5.x cards are used, the user has eleven (11) outputs available. Refer to Table 3-2: TRANS 01-D I/O options for more information.

The TRANS 01-D recognizes an Immediate Stop condition after a Soft Fault has been cleared or if an Error occurred and was removed during the cycle. It occurs when the system is running the program and the enable goes low. It occurs when the system is in manual mode and the forward input goes low while running the forward program or the reverse input goes low while running the reverse program.

Enter the value to be used for this parameter. Press ENTER when all data is confirmed and the TRANS 01-D will store the data for this parameter and step to the next parameter.

Tip: If you make a mistake entering a value within this parameter, press the ESC key on the CTA10-1 and enter the correct value. However; if you realize that you entered an incorrect value after pressing ENTER and proceeding to the next parameter, use the down arrow to return to the previous parameter, press ENTER and correct any errors.

P05 Automatic/Manual Switching

```
P05 Auto/Manual
Switching
→1.End of Cycle
 2.Immediate
```

1 or **2** - Select the option desired when the mode of the TRANS 01-D is switched during a cycle. Parameters that are listed with a number can be selected by the numerical keypad on the CTA10-1 or by using the up and down arrows.

Access Method	Identification	Permissible Values
CTA10-1 or BTC06-1	P05	1 (end of cycle) 2 (immediate)
VisualTRANS	C-0-0302	0 (immediate) 1 (end of cycle)
Serial Protocol	CP x.302	Same as above
		Default: end of cycle

If the mode of the TRANS 01-D is changed while it is in cycle, changing from Automatic to Manual mode, the user must tell the TRANS 01-D how to respond. Do they want it to finish the cycle and then change modes? If so, press 1. If they want it to come to an Immediate Stop in mid cycle, press 2.

Enter the value to be used for this parameter. Press ENTER when all data is confirmed and the TRANS 01-D will store the data for this parameter and step to the next parameter.

Tip: If you realize that you entered an incorrect value after pressing ENTER and proceeding to the next parameter, use the down arrow to return to the previous parameter, press ENTER and correct any errors.

P06 System Options

```
P06 System Optns
Spindle Position
→1.Enabled
 2.Disable
```

```
P06 System Optns
Spindle Position
→1.Disabled
 2.Enable
```

1 or **2** – Choose 1 to leave as currently configured. Choose 2 to toggle. Choices that are listed with a number can be selected by the numerical keypad on the CTA10-1 or by using the up and down arrows.

Access Method	Identification	Permissible Values
CTA10-1 or BTC06-1	P06	spindle positioning disabled spindle positioning enabled
VisualTRANS	C-0-0307 (Bit 0)	0x0000 (spindle positioning disabled and manual mode ready disabled) 0x0001 (spindle positioning enabled and manual mode ready disabled) 0x0002 (spindle positioning disabled and manual mode ready enabled) 0x0003 (spindle positioning enabled and manual mode ready enabled)
Serial Protocol	CP x.307	Same as above
		Default: spindle positioning disabled

Spindle Positioning: When the TRANS 01-D is used to control a spindle, setting to Enabled will allow the user to program the spindle to a position as well as to a speed. When set to disabled, the user will not be able to program a spindle position in a program block. If a position is programmed in a program block without this option disabled, an error will result when the program block is executed.

```
P06 System Optns
ManualMode Ready
→1.Enabled
 2.Disable
```

```
P06 System Optns
ManualMode Ready
→1.Disabled
 2.Enable
```

Manual Mode Ready: **1** or **2** – Choose 1 to leave as currently configured. Choose 2 to toggle. Choices that are listed with a number can be selected by the numerical keypad on the CTA10-1 or by using the up and down arrows.

Access Method	Identification	Permissible Values
CTA10-1 or BTC06-1	P06	Manual Mode Ready disabled Manual Mode Ready enabled
VisualTRANS	C-0-0307 (Bit 1)	0x0000 (spindle positioning disabled and Manual Mode Ready disabled) 0x0001 (spindle positioning enabled and Manual Mode Ready disabled) 0x0002 (spindle positioning disabled and Manual Mode Ready enabled) 0x0003 (spindle positioning enabled and Manual Mode Ready enabled)
Serial Protocol	CP x.307	Same as above
		Default: Manual Mode Ready disabled

Enter the value to be used for this parameter. Press ENTER when all data is confirmed and the TRANS 01-D will store the data for this parameter and step to the next parameter.

Tip: If you realize that you entered an incorrect value after pressing ENTER and proceeding to the next parameter, use the down arrow to return to the previous parameter, press ENTER and correct any errors.

P07 Language

```
P07 Language
 1.German
→2.English
 3.French
```

1, 2, or **3 -** Select the option for the desired language. Parameters that are listed with a number can be selected by the numerical keypad on the CTA10-1 or by using the up and down arrows.

Access Method	Identification	Permissible Values
CTA10-1 or BTC06-1	P07	1 (German) 2 (English) 3 (French)
VisualTRANS	C-0-0001	0 (German) 1 (English) 2 (French)
Serial Protocol	CP 0.1	Same as above
		Default: English

The messages generated by the TRANS 01-D are available in three languages. When a language is selected, the information given by the TRANS 01-D will be given in the selected language. This also includes the information given by the digital servo drive when used as extended messages.

When English and German are selected, all information will be in the language selected. All information received from the servo drive will remain in English or German.

Enter the value to be used for this parameter. Press ENTER when all data is confirmed and the TRANS 01-D will store the data for this parameter and step to the next parameter.

Tip: If you realize that you entered an incorrect value after pressing ENTER and proceeding to the next parameter, use the down arrow to return to the previous parameter, press ENTER and correct any errors.

P08 Maximum Path Speed

```
P08 Max. Path
    Speed
   nnnn.n (UPM)
```

(n)nnnnnn - Enter the speed to be used for the specified function.

The units of measure displayed in this screen are a function of the units configured in axis parameter Aa02 for all enabled linear axes in the system. If the units for all of the enabled linear axes are the same (either inch or mm), the corresponding units (inch/min or mm/min) will be displayed in P08. If the units on all enabled linear axes are not the same, the symbol “UPM” will be displayed here to indicate that the units of measure cannot be determined. The units of all linear axes in the system must be the same for multi-axis moves to be scaled properly. Once the units are properly configured in Aa02 for all axes, returning to this screen will show the correct velocity units.

Access Method	Identification	Permissible Values
CTA10-1 or BTC06-1	P08	0.1 - 99999.9
VisualTRANS	T-0-0020	nnnnnnn.nnn
Serial Protocol	TP 3.20	Same as above
		Default: 1000 units per minute

Note: When setting task parameter values, keep in mind that Task C is the only valid task in the TRANS 01-D.

The values entered in this parameter will be used as the speeds for the various functions specified.

Enter the value to be used for this parameter. Press ENTER when all data is confirmed and the TRANS 01-D will store the data for this parameter and step to the next parameter.

Tip: If you make a mistake entering a value within this parameter, press the ESC key on the CTA10-1 and enter the correct value. However; if you realize that you entered an incorrect value after pressing ENTER and proceeding to the next parameter, use the down arrow to return to the previous parameter, press ENTER and correct any errors.

P09 Maximum Path Acceleration

```
P09 Max. Path
  Acceleration
    nnn.n(UPM)
```

(n)nnnnn - Enter the acceleration rate to be used for the specified function.

The units of measure displayed in this screen are a function of the units configured in axis parameter Aa02 for all enabled linear axes in the system. If the units for all of the enabled linear axes are the same (either inch or mm), the corresponding units (inch/sec^2 or mm/sec^2) will be displayed in P09. If the units on all enabled linear axes are not the same, the symbol "UPM" will be displayed here to indicate that the units of measure cannot be determined. The units of all linear axes in the system must be the same for multi-axis moves to be scaled properly. Once the units are properly configured in Aa02 for all axes, returning to this screen will show the correct acceleration units.

Access Method	Identification	Permissible Values
CTA10-1 or BTC06-1	P09	0.01 - 99999.9
VisualTRANS	T-0-0021 T-0-0022	nnnnnn.n (max. path accel.) nnnnnn.n (max. path decel.)
Serial Protocol	TP 3.21 TP 3.22	Same as above
		Default: 200 units per $second^2$

Note: When setting task parameter values, keep in mind that Task C is the only valid task in the TRANS 01-D.

The values entered in this parameter will be used as the accel/decel rates for the various functions specified.

Note: Although VisualTRANS and Serial Protocol have access to separate acceleration and deceleration parameters, TRANS 01-D firmware version 6VRS requires that the same values be used for both parameters.

Enter the value to be used for this parameter. Press ENTER when all data is confirmed and the TRANS 01-D will store the data for this parameter and step to the next parameter.

Tip: If you make a mistake entering a value within this parameter, press the ESC key on the CTA10-1 and enter the correct value. However; if you realize that you entered an incorrect value after pressing ENTER and proceeding to the next parameter, use the down arrow to return to the previous parameter, press ENTER and correct any errors.

P10 Transfer Enable

```
P10 Xfer Enable
X-Axis   nnnn
Max      n.n
Min      n.n
```

nnnn - automatically loads I/O configuration set in parameter P02 for each axis. To display any additional configured linear axes, press the ENTER key to scroll through the values and display the next available axis.

n.n - Max. and Min. values are limited by parameter Aa06, Overtravel limits, for each axis.

Access Method	Identification	Permissible Values
CTA10-1 or BTC06-1	P10	Max. - limited by positive overtravel limit Aa06 Min. - limited by negative overtravel limit Aa06
VisualTRANS	S-0-0049 S-0-0050	± 2147483647 (positive travel limit) ± 2147483647 (negative travel limit)
Serial Protocol	DP d.49 DP d.50	Same as above
		Default: 0

A Transfer Enable Range **Max** Limit parameter and a Transfer Enable Range **Min** Limit parameter exist for each linear axis configured in process parameter **P02**. An error check is performed on these parameters when the TRANS 01-D exits parameter mode. If the positive limit is strictly less than the negative limit, an error is generated and the TRANS 01-D is prevented from leaving parameter mode.

Note: The Transfer Range is disabled for a given axis when both of its Transfer Enable limits are set to zero, otherwise the Transfer Range is enabled for that axis.

Only axes which meet all of the following criteria will be included in the evaluation of the *Transfer Enable* output. In what follows, axes that meet all of the following criteria are called *valid for consideration*.

- Axis is X, Y, or Z (not the spindle).
- Axis is enabled (via P02, the Axis Configuration parameter).
- Axis is configured for linear (mm or inch units), rather than rotary motion.
- The *Transfer Range* is enabled for the axis.
- The *Transfer Enable* output will be true when ALL of the following criteria are met, otherwise the output will be false…
- The TRANS 01-D is in either Manual or Automatic mode.
- The TRANS 01-D is <u>not</u> in a fault condition (i.e., the No Fault output is True).
- At least one axis is valid for consideration.

All axes which are valid for consideration are referenced (Homed).

The feedback position of **all** axes which are valid for consideration is greater than or equal to the *Transfer Enable Range Min Limit* and less than or equal to the *Transfer Enable Range Max Limit* (the range is inclusive of the limits).

3.3 Axis Parameters

Only those servo and spindle axes that were activated and configured in P02 Axis Configuration, page 3-15 will be available for selection.

```
Select Axis
→1.X-Axis
 2.Y-Axis
 3.Z-Axis
```

```
Select Axis
 2.Y-Axis
 3.Z-Axis
 4.S-Axis
```

After the desired axis is selected, the Parameter Number screen is the primary screen from which all axis parameters can be selected. Each parameter can be selected by entering it's number in this primary screen or by scrolling up or down using the arrow keys and pressing ENTER.

```
Parameter Number
For X-Axis(0-34)
 Aa#=    0   ← Axis Parameter Number
:Sercos #
```

Aa00 Parameter Set

```
Aa00 Parameter
Set For a-Axis

   SERCOS#nn
```

a - Axis designation. Can be X, Y, Z, or S.

nn - Servo axis number set by the rotary switches (S2 low) and (S3 high) located on the DSS card plugged into the servo drive for this axis. This number must be 01, 02, 03 or 04.

The TRANS 01-D will always designate drive #01 as the X axis, drive #02 as the Y axis, drive #03 as the Z axis and drive #04 as the S or spindle axis. For this reason, the following table must be followed when assigning axis and drive numbers for the TRANS 01-D system:

Access Method	Permissible Values
DSS card switch setting	01 (X axis) 02 (Y axis) 03 (Z axis) 04 (S axis)

The TRANS 01-D will display the SERCOS # of the first axis it finds on the SERCOS ring (lowest drive #). If the number shown as the SERCOS number does not match the table shown above, an ERROR will result. To correct this error, the switches on the DSS card must be changed to match the correct axis designation. After the switch settings are changed, you must re-cycle power to the digital drive for the switch settings to take effect.

Each servo drive on the SERCOS ring must have a unique two digit identifier number. This number is set using the two rotary switches (S2 low) and (S3 high) mounted on the DSS 1.3 found in slot U1 of the digital drive. The S3 high switch is the first digit and the S2 low switch is the second digit.

Example For drive number 03, S3 high would be set to “0” and S2 low would be set to “3”.

Aa01 Special Functions Enables - Feed to Positive Stop

```
Aa01 Special
Function Enables
1.Positive Stop
                n
```

n - Enter a 1 here to enable Feed to a Positive Stop or a 0 to disable this function.

Access Method	Identification	Permissible Values
CTA10-1 or BTC06-1	Aa01	0 (positive stop not available) 1 (positive stop available)
VisualTRANS	A-0-0301	bit 1 = 0, i.e., xxxxxxxxxxxxxxx0 (positive stop not available) bit 1 = 1, i.e., xxxxxxxxxxxxxxx1 (positive stop available)
Serial Protocol	AP a.301	Same as above
		Default: positive stop not available

When this screen comes up, the cursor will be blinking in the lower right-hand corner of the display. If the programmer is required to program the axis to position (or home) against a positive stop, this parameter must be enabled. When this parameter is set to a 1, the programmer will be able to call up programming functions G75 and G69 in the user program. If this bit is set to 0, the user will not be given these commands as an option when programming block functions.

The programmer will have the ability to select more than one option under this parameter. When you are at the option you want to enable, enter a 0 or a 1. Pressing the ENTER key will step to the next parameter option.

Note: The functions selected in this parameter will not be enabled until the user has stepped through all of the options in this parameter. After moving into the next parameter (Aa02), the CTA10-1 will enable the options selected. If the user exits in the middle of Aa01, the selected functions will not be enabled. When using VisualTRANS or Serial Protocol, the options will be enabled when the user exits Parameter Mode.

After ENTER is pressed, the next option within Special Functions, Adaptive Depth, will be displayed.

Aa01 Special Functions Enables - Adaptive Depth

```
Aa01 Special
Function Enables
2.Adaptive Depth
               n
```

n - Enter a 1 here to enable positioning using Adaptive Depth or a 0 to disable this function.

Access Method	Identification	Permissible Values
CTA10-1 or BTC06-1	Aa01	0 (adaptive depth disabled) 1 (adaptive depth enabled)
VisualTRANS	A-0-0301	bit 6 = 0, i.e., xxxxxxxxxx0xxxxx (adaptive depth disabled) bit 6 = 1, i.e., xxxxxxxxxx1xxxxx (adaptive depth enabled)
Serial Protocol	AP a.301	Same as above
		Default: adaptive depth disabled

When this screen comes up, the cursor will be blinking in the lower right-hand corner of the display. If the user program requires Adaptive Depth, then this parameter must be set to 1. When enabled, the programmer will be allowed to use programming function G08 in their user program. If this bit is set to 0, the user will not be given G08 as an option when programming block functions.

Note: The functions selected in this parameter will not be enabled until the user has stepped through all of the options in this parameter. After moving into the next parameter (Aa02), the CTA10-1 will enable the options selected. If the user exits in the middle of Aa01, the selected functions will not be enabled. When using VisualTRANS or Serial Protocol, the options will be enabled when the user exits Parameter Mode.

The programmer will have the ability to select more than one option under this parameter. When you are at the option you want to enable, enter a 0 or a 1. Pressing the ENTER key will step to the next parameter option, Home switch Monitoring.

Note: Using Adaptive Depth programming requires additional hardware for the servo drive. Check machine documentation or contact your Indramat Application Engineer for the correct hardware requirements.

Aa01 Special Functions Enables - Home Switch Monitoring

```
Aa01 Special
Function Enables
3.Home Switch
Monitoring      n
```

Note: This option should not be enabled when using an Absolute Encoder for positioning (while absolute feedback is enabled).

n - Enter a 1 here to enable Home Switch Monitoring or a 0 to disable this function.

Access Method	Identification	Permissible Values
CTA10-1 or BTC06-1	Aa01	0 (Home switch monitor disabled) 1 (Home switch monitor enabled)
VisualTRANS	A-0-0301	bit 5 = 0, i.e., xxxxxxxxxxx0xxxx (Home switch monitor disabled) bit 5 = 1, i.e., xxxxxxxxxxx1xxxx (Home switch monitor enabled)
Serial Protocol	AP a.301	Same as above
		Default: Home switch monitor disabled

The TRANS 01-D can monitor the Home Switch at all times and give an error message if it is activated when the axis is off of the switch or if it is activated in a different position than the first time it was activated.

If the Home Switch input should go high whenever the TRANS 01-D has the axis moved off of the switch, the TRANS 01-D can monitor this input and issue a warning diagnostic. This diagnostic and the error will be issued at the end of the current machining cycle, such as when a Jump and Stop is executed. This diagnostic is not a hard fault that requires a system reset, but a soft fault that is meant to let the operator know that the Home switch input was unstable during the last cycle.

If the axis has already been Homed and an absolute move to “0” is commanded in a program block, the TRANS 01-D will check to make sure the Home switch is made within the same revolution as it was when the axis was first Homed. If it is not, the digital drive will issue a “35” error. If the axis is commanded to move off of the Home switch and it does not move off of the Home switch within 2.1 encoder revolutions, the TRANS 01-D will issue the diagnostic "Home Switch Error”.

Note: The functions selected in this parameter will not be enabled until the user has stepped through all of the options in this parameter. After moving into the next parameter (Aa02), the CTA10-1 will enable the options selected. If the user exits in the middle of Aa01, the selected functions will not be enabled. When using VisualTRANS or Serial Protocol, the options will be enabled when the user exits Parameter Mode.

The programmer will have the ability to select more than one option under this parameter. When you are at the option you want to enable, enter a 0 or a 1. Pressing the ENTER key will step to the next parameter.

Aa02 Units

```
Aa02 Units
→1.Inches
 2.Millimeters
 3.RPM
```

Press the number key or use the up and down arrows to move the arrow to the measuring system you want to use for this axis

In this parameter the user specifies which measuring units will be used for this axis. Only one unit may be chosen. The currently active unit of measure has a small arrow to the left of the number while the number and text are flashing.

- **1 - Inches:** All programmed distances and destinations will be in inches. Feedrates will be in inches per minute. All Tool Correction data will be in inches.
- **2 - MM:** All programmed distances and destinations will be in millimeters. Feedrates will be in millimeters per minute. All Tool Correction data will be in millimeters.
- **3 - RPM:** Not yet implemented.
- **4 - Unit/Rev.:** You have to use the down arrow to display this 4th entry. Refer to the next page for an explanation of this Unit.

Note: In order to activate any of these Units, the desired Unit must be entered twice.

Access Method	Identification	Permissible Values
CTA10-1 or BTC06-1	Aa02	1 (inches) 2 (mm) 3 (RPM) 4 (units per table revolution)
VisualTRANS	A-0-0302	0 (inches) 1 (mm) 3 (units per table revolution)
Serial Protocol	AP a.302	Same as above
		Default: mm for release 06V48 and later. (inches for releases prior to 06V48)

When a different Units selection is entered other than the current, the TRANS 01-D system will momentarily initialize to Phase 4 and then return to Phase 2. This will set the new units into the system. All subsequent parameters that relate to speeds and positions **must** be re-entered. The TRANS 01-D does not re-calculate new values when the type of units used is changed, it will only move the decimal point.

Warning

Possible error when changing units

⇒ If the user is changing the measuring units after values have already been entered in other parameters, those values must be re-entered. The TRANS 01-D will not convert or re-calculate values when the units are changed.

Pressing any key except 4 will enable that measuring system. See the next page for an explanation of key number 4.

```
Aa02 Units                 Aa02 Units
 2.Millimeters             Enter UnitsPer
 3.RPM                     Table Revolution
→4.Units/Rev.                nnnnnnnn
```

Warning

Motion error when changing Units

⇒ If units are changed from linear to rotary or rotary to linear, the TRANS 01-D must be rest (powered down and re-powered) before any motion is performed.

Press the number key or use the up and down arrows to move the arrow to the measuring system you want to use for this axis

In this parameter the user specifies which measuring units will be used for this axis.

nnnnnnnn - Enter the number of units per table revolution.

- **4 - Units per table revolution:** Used for Rotary applications. When this option is selected, the next screen to appear will require an entry to specify the unit for the rotary application. The value entered here will be the number of units the TRANS 01-D will use for each revolution of the rotary axis. This parameter determines how many "display-programming" units one revolution of the drive train output (table, for example) will be divided into. Any convenient value between 10 and 1000 may be set into this parameter, with three decimal place precision (e.g., 10.000 to 1000.000). Speeds in both parameters and programs are expressed in units/table rev/min. Tool Correction values will also be in units per table rev.

Access Method	Identification	Permissible Values
CTA10-1 or BTC06-1	Aa02	10.000 - 1000.000
VisualTRANS	A-0-0302 S-0-0103	3 (modulo) 0 - 214748.3647 (modulo value)
Serial Protocol	AP a.302 DP d.103	Same as above
		Default: 360

For example, if programming in degrees is desired, this parameter would be 360. Programming as well as the position display would then be in degrees, with a resolution down to 0.001 degrees. Speeds would be in degrees/minute.

When a different Units selection is entered, the TRANS 01-D system will momentarily initialize to Phase 3 and then return to Phase 2. This will set the new units into the system. All subsequent parameters that relate to speeds and positions **must** be re-entered.

Press the ENTER key when all data is entered and all of the information entered for this parameter will be stored and the TRANS 01-D will jump to parameter Aa03.

Aa03 Feed Constant

```
Aa03 Feed
   Constant
     (UM)
    nnnnnnnn
```

nnnnnnnn - Enter the calculated Feed Constant for this axis in the units selected in Parameter Aa02 Units, page 3-30.

UM - The units of measure chosen in Parameter Aa02 will be displayed here for the programmer's reference. This is displayed for reference only and cannot be changed in this parameter. The units can only be changed in Parameter Aa02

Note: This parameter is not used when a rotary application has been selected for the axis (Axis Parameter Aa02 has been configured with Units per Table Revolution).

Access Method	**Identification**	**Permissible Values**
CTA10-1 or BTC06-1	Aa03	
VisualTRANS	S-0-0123	0 - 21478.3647
Serial Protocol	DP d.123	Same as above
		Default: 1 inch or 10 mm

There are many different types of mechanical configurations available for use with electronic servo systems. The parameters of the TRANS 01-D are designed to accept all of them.

This number is the distance the axis will travel for one revolution of the feedback device. When using a motor mounted feedback device, this is also equal to the distance the axis will travel for one revolution of the motor. Some formulas for calculating the axis Feed Constant:

For ballscrews:

$$\frac{\text{Ballscrew lead}}{\text{Gear ratio}}$$

for rack and pinion:

$$\frac{\text{(Pinion diameter) x } \Pi}{\text{Gear ratio}}$$

for roller systems:

$$\frac{\text{(Roll diameter) x } \Pi}{\text{Gear ratio}}$$

If you have used the **gear ratio** in your calculation of the feed constant, you must enter 1:1 in parameter **Aa05**. Otherwise, calculate your feed constant without the gear ratio. Then enter your gear ratio in Aa05. The TRANS 01-D will then internally calculate the current value for the system.

If you are unsure of the formula to use, call the Indramat Service Hot Line at 800-860-1055.

Press ENTER when all data is entered and the TRANS 01-D will store all the data for this parameter and step to the next parameter.

Aa04 Positioning Feedback Type - Motor Encoder

```
Aa04 Positioning        Aa04 Primary
Feedback Type           Positioning Enc.
→1.Motor Encoder        →1.Motor Encoder
 2.Linear Scale          2.Linear Scale
```

Press the number key or use the up and down arrows to move the arrow to the type of positioning device you want to use for this axis. When selecting 1, the digital servo drive will automatically configure itself for the motor encoder.

Note: **After selecting 1 for Motor Encoder, a second entry similar to the first must be made if the motor encoder is to be used as the primary positioning device.** If no other positioning device is connected to the TRANS 01-D system, select 1 at this screen. By doing this, all positional moves in the user program will be based upon the position of the motor encoder and the next parameter will be displayed.

If the motor encoder is different than the last time the drive was powered up, you will get a **UL error** on the digital drive H1 display. Pressing the S1 reset switch on the digital drive will load the parameters for the new feedback into the servo drive.

Access Method	**Identification**	**Permissible Values**
CTA10-1 or BTC06-1	Aa04	1 (use motor encoder) 2 (use external linear scale) 3 (use external rotary encoder)
VisualTRANS	A-0-0004	bit 11 = 0, i.e., xxxxx0xxxxxxxxxx (use motor fdbk as primary device) bit 11 = 1, i.e., xxxxx1xxxxxxxxxx (use external fdbk as primary device)
Serial Protocol	DP d.4	Same as above
		Default: use motor feedback

Every Indramat digital servo drive uses the motor encoder for axis control. It can also use it for axis positioning. If your application will be using the motor encoder for axis positioning, then select 1 for this parameter.

Refer to the subsections for Aa04 Positioning Feedback Type - Linear Scale or Aa04 Positioning Feedback Type - External Rotary Absolute Encoder if one of these types of feedback devices is to be used.

The option entered here is written to the TRANS 01-D Axis parameter A-0-0004. If the external encoder is to be used as the primary positioning device, the CTA10-1 will set Axis parameter A-0-0004 bit 10 to a 1 for a linear scale or an external rotary encoder. The data entered into this parameter determines what the TRANS 01-D will write to Drive Parameter S-0-0032. The user cannot change this option by writing to drive parameter S-0-0032 directly because the TRANS 01-D will overwrite parameter S-0-0032 based upon the data in A-0-0004 when it exits Parameter Mode.

Aa04 Positioning Feedback Type - Linear Scale

```
Aa04 Positioning
Feedback Type
 1.Motor Encoder
→2.Linear Scale
```

```
Aa04 Primary
Positioning Enc.
 1.Motor Encoder
→2.Linear Scale
```

```
Aa04 Linear
Scale Resolution
   (UM/Pulse)
     nnnnn
```

This screen appears when 2. Linear Scale is selected.

Press 2 to select Linear Scale as the positioning feedback or use the up and down arrows and press ENTER. If an external linear scale is used for primary axis positioning, select 2 at the Primary Positioning Encoder screen. The next screen that appears is the Linear Scale Resolution screen and requires that you enter the distance per pulse for the linear scale you are using.

Note: Linear Scale resolution specifications are usually contained in the manufacturer's documentation. It may also be contained in the machine documentation. Please consult this documentation or call the Indramat Service Hotline at 800-860-1055.

When a value is entered on the second screen, the TRANS 01-D will store the data and step to the next parameter.

nnnnn - Enter the distance per pulse of the linear scale being used for positioning.

Access Method	Identification	Permissible Values
CTA10-1 or BTC06-1	Aa04	1 (use motor encoder) 2 (use external linear scale) 3 (use external rotary encoder)
VisualTRANS	A-0-0004 S-0-0118	bit 11 = 0, i.e., xxxxx0xxxxxxxxxx (use motor fdbk as primary device) bit 11 = 1, i.e., xxxxx1xxxxxxxxxx (use external fdbk as primary device) Set resolution for external linear scale: 0.0 - 21474.83647
Serial Protocol	AP a.4 AP a.118	Same as above
		Default: use motor feedback

Note: Additional interface cards may be necessary when external feedback devices are used. Please consult machine documentation or call the Indramat at 800-860-1055.

The option selected here is written to the TRANS 01-D Axis parameter A-0-0004. If the external encoder is to be used as the primary positioning device, the CTA10-1 will set Axis parameter A-0-0004 bit 10 to a 1 for a linear scale or an external rotary encoder. The data entered into this parameter determines what the TRANS 01-D will write to Drive Parameter S-0-0032. The user cannot change this option by writing to drive

parameter S-0-0032 directly because the TRANS 01-D will overwrite parameter S-0-0032 based upon the data in A-0-0004 when it exits Parameter Mode.

The values entered in the last screen are entered into Drive Parameter S-0-0118. This parameter can also be set through VisualTRANS and the Serial Protocol.

Aa04 Positioning Feedback Type - External Rotary Encoder

```
Aa04 Positioning
Feedback Type
 2.Linear Scale
→3.External Enc.
```

```
Aa04 Primary
Positioning Enc.
 2.Linear Scale
→3.External Enc.
```

```
Aa04 Rotary
Resolution
     (LPR)
        nnnn
```

This screen appears when 3. External Encoder is selected.

Press 3 to select an External Rotary Encoder as the positioning feedback or use the up and down arrows and press ENTER. If the external rotary encoder is used for primary axis positioning, select 3 at the Primary Positioning Encoder screen. The next screen that appears is the Rotary Resolution screen and requires that you enter the lines per revolution (LPR) for the external rotary encoder you are using.

Note: External rotary encoder specifications are contained in the manufacturer's documentation. It may also be contained in the machine documentation. Please consult this documentation or call the Indramat Service Hotline at 800-860-1055.

When a value is entered on the second screen, the TRANS 01-D will store the data and step to the next parameter.

nnnn - Enter the line count per revolution of the external encoder being used.

Access Method	Identification	Permissible Values
CTA10-1 or BTC06-1	Aa04	1 (use motor encoder) 2 (use external linear scale) 3 (use external rotary encoder)
VisualTRANS	A-0-0004 S-0-0117	bit 11 = 0, i.e., xxxxx0xxxxxxxxxx (use motor fdbk as primary device) bit 11 = 1, i.e., xxxxx1xxxxxxxxxx (use external fdbk as primary device) Set resolution for external rotary encoder: 0.0 - 21474.83647
Serial Protocol	DP d.4 DP d.117	Same as above
		Default: use motor feedback

Note: Additional interface cards may be necessary when external feedback devices are used. Table 3-6 below shows typical values of the additional interface type number. These may vary depending upon the version of drive firmware being used. Refer to the drive firmware HELP file or documentation for details. If additional information is required, please consult machine documentation or call Indramat at 800-860-1055.

Module	P-0-0075	Measurement system
--	0	None
Standard	1	Digital servo feedback
DLF01.1M	2	Incremental encoder with sine signals from the Heidenhain Company, with either uA or 1V signals
DZF02.1M	3	Indramat gear-type encoder
DFF01.1M	4	Digital servo feedback from the Heidenhain or Stegmann companies
DEF01.1M	5	Incremental encoder with square-wave signals from the Heidenhain company
DEF02.1M	6	Incremental encoder with square-wave signals from the Heidenhain company
DAG01.2M	7	Encoder with SSI interface
DAG01.2M	8	Encoder with EnDat interface
DZF03.1M	9	Gearwheel encoder with 1Vpp signals

Table 3-6: P-0-0075, Interface feedback 2, external

The option selected here is written to the TRANS 01-D Axis parameter A-0-0004. If the external encoder is to be used as the primary positioning device, the CTA10-1 will set Axis parameter A-0-0004 bit 10 to a 1 for a linear scale or an external rotary encoder. The data entered into this parameter determines what the TRANS 01-D will write to Drive Parameter S-0-0032. The user cannot change this option by writing to drive parameter S-0-0032 directly because the TRANS 01-D will overwrite parameter S-0-0032 based upon the data in A-0-0004 when it exits Parameter Mode.

The values entered in the last screen are entered into Drive Parameter S-0-0117. This parameter can also be set through VisualTRANS and the Serial Protocol.

Aa05 Gear Ratio

```
Aa05 Gear Ratio
Revs In:Revs Out
  nnnn : nnnn
```

nnnn - Enter the input and output turns for the ratio.

Access Method	Identification	Permissible Values
CTA10-1 or BTC06-1	Aa05	1 - 9999 (revs in and revs out)
VisualTRANS	S-0-0121 S-0-0122	1 - 2147483647 (gearbox input revolutions) 1 - 2147483647 (gearbox output revolutions)
Serial Protocol	DP d.121 DP d,122	Same as above
		Default: 1 : 1

When this screen first appears, the cursor will be flashing within the "Revs In" value. Enter the desired value for Revs In, press ENTER and the cursor will jump to the "Revs Out" value. Now enter the desired value for Revs Out.

Enter the value to be used for this parameter. Press ENTER when all data is confirmed and the TRANS 01-D will store the data for this parameter and step to the next parameter.

Tip: If you make a mistake entering a value within this parameter, press the ESC key on the CTA10-1 and enter the correct value. However; if you realize that you entered an incorrect value after pressing ENTER and proceeding to the next parameter, use the down arrow to return to the previous parameter, press ENTER and correct any errors.

Aa06 Overtravel Limits

```
Aa06 Overtravel
Limits (Units)
Travel Limit On?
ENTER=OK, ESC=NO
```

When the Overtravel Limits screen appears, you must first answer the question, "Travel Limits On?" If no travel limits are to be specified, press the ESC key on the CTA10-1 and the next parameter will be displayed. However, if travel limits need to be set, press the ENTER key and the + Limit input value screen will appear.

```
Aa06 Overtravel
Limits(Units)
1.+Limit nnnnn
```

```
Aa06 Overtravel
Limits(Units)
2.-Limit nnnnn
```

nnnnn - Enter the extreme +/- travel distances for this axis.

Note that a programmed move cannot actually move exactly to the overtravel limit. The target position of any program move must not be within 2 times the position window (configured in parameter Aa17A) of the software overtravel limit. When jogging, the axis will also be stopped at a distance 2 times the position window away from the overtravel limit.

Access Method	Identification	Permissible Values
CTA10-1 or BTC06-1	Aa06	
VisualTRANS	S-0-0049 S-0-0050	± 2147483647 (positive travel limit) ± 2147483647 (negative travel limit)
Serial Protocol	DP d.49 DP d,50	Same as above
		Default: 0

The values to be used as positive and negative software (over)travel limits are entered here.

The + Overtravel Limit screen will appear first. After entering the proper value, press ENTER and the CTA10-1 will jump to the - Overtravel Limit value. After entering this value, pressing ENTER will store both values into the TRANS 01-D and step the programmer to the next parameter.

Note: Entering 0 for both your + and - travel limits disables the travel limits and the following screen appears.

```
Software Travel
Limits Disabled
```

Press ENTER when each Overtravel Limit is entered and the TRANS 01-D will store all the data for this parameter and step to the next parameter.

Aa07 Bipolar Torque Limit

```
Aa07 Bipolar
Torque Limit %
      nnn.n
```

nnnn - Enter the value, in percentage, for the selected torque to be used.

This value is a percentage of the system's continuous torque. The bipolar torque limit value determines the maximum allowable torque in either direction.

Access Method	Identification	Permissible Values
CTA10-1 or BTC06-1	Aa07	0 - 400%
VisualTRANS	S-0-0092	0 - 3276.7
Serial Protocol	DP d.92	Same as above
		Default: 400%

Enter the value to be used for this parameter. Press ENTER when all data is confirmed and the TRANS 01-D will store the data for this parameter and step to the next parameter.

Tip: If you make a mistake entering a value within this parameter, press the ESC key on the CTA10-1 and enter the correct value. However; if you realize that you entered an incorrect value after pressing ENTER and proceeding to the next parameter, use the down arrow to return to the previous parameter, press ENTER and correct any errors.

Aa08 Axis Gains

```
Aa08 Axis Gains
→1.Set Gains
 2.Load Default
```

```
Aa08 Axis Gains
KV          nn.nn
P-Gain        n.n
V-Loop INT  nnn.n
```

nnn - Enter the gain factors to be used for the appropriate axis.

Access Method	Identification	Permissible Values
CTA10-1 or BTC06-1	Aa08	0.1 - 29 (KV) 0.01 - 655.35 (Proportional Gain) 0 - 6553.5 (Velocity Loop Integral Reaction Time)
VisualTRANS	S-0-0104 S-0-0100 S-0-0101	Same as above
Serial Protocol	DP d.104 DP d.100 DP d.101	Same as above
		Default: dependent on attached servo system

The screen on the left comes up first asking the programmer if they want to set the gains themselves, or if they want to use the standard system gains.

If the programmer chooses "Set Gains", the following options are given:

- KV - The position loop gain desired should be entered here. Default value is 1. The K_V –factor determines the gain of the position loop regulator throughout the entire velocity range.
- P-Gain - The proportional gain should be entered here. This is a proportional gain only for the velocity loop regulator.
- V-Loop INT - The velocity loop integral reaction time should be entered here. This value relates the velocity loop proportional gain, Kp to the velocity loop integral gain by the ratio:

$$K_i = K_p / t_n$$

Where tn is the velocity loop integral reaction time.

The definition of t_n is the time when the K_i gain equals the K_p gain.

If "Load Defaults" is selected, the TRANS 01-D will automatically set the default systems gains in the servo drive. These gains are based on the assumption that the inertia relationship of motor to load is 1:1. The CTA10-1 will tell the user when it is loading the default gains.

```
Loading...
Please Wait!
```

After the default gains are loaded, they will be displayed and the programmer can still modify the value or press ENTER for each value until the next parameter is displayed.

Tip: If you make a mistake entering a value within this parameter, press the ESC key on the CTA10-1 and enter the correct value. However; if you realize that you entered an incorrect value after pressing ENTER and proceeding to the next parameter, use the down arrow to return to the previous parameter, press ENTER and correct any errors.

Aa09 Ramp

```
Aa09 Ramp

Ramp:          nnn.
        UPM
```

nnnn - Enter the value to be used as the specified acceleration/deceleration ramps.

UPM - The unit per measure chosen in Parameter Aa02 will be displayed here for the programmers reference. This is displayed for reference only and cannot be changed in this parameter. The units can only be changed in Parameter Aa02

Access Method	Identification	Permissible Values
CTA10-1 or BTC06-1	Aa09	0 - System Max (max. acceleration) 0 - System Max (max. deceleration)
VisualTRANS	A-0-0021 A-0-0022	Same as above
Serial Protocol	AP a.21 AP a.22	Same as above
		Default: 200

The Ramp will be the rate used as the primary acceleration rate for this axis. The axis acceleration is limited to this value during a coordinated (interpolated) move. At the drive level, the acceleration capability is limited by the amount of peak torque that the drive and motor are rated for.

Enter the values to be used for this parameter. Press ENTER when all data is confirmed and the TRANS 01-D will store the data for this parameter and step to the next parameter.

Tip: If you make a mistake entering a value within this parameter, press the ESC key on the CTA10-1 and enter the correct value. However; if you realize that you entered an incorrect value after pressing ENTER and proceeding to the next parameter, use the down arrow to return to the previous parameter, press ENTER and correct any errors.

Aa10 Speeds

```
Aa10 Speeds
    Homing
    nnnnnn (UPM)
```

```
Aa10 Speeds
    Maximum
    nnnnnn (UPM)
```

```
Aa10 Speeds
  Slow Jog
    nnnnnn (UPM)
```

```
Aa10 Speeds
  Rapid Jog
    nnnnnn (UPM)
```

(n)nnnnn - Enter the speed to be used for the specified function.

UPM - The unit per measure chosen in Parameter Aa02 will be displayed here for the programmer's reference. This is displayed for reference only and cannot be changed in this parameter. The units can only be changed in Parameter Aa02

Access Method	Identification	Permissible Values
CTA10-1 or BTC06-1	Aa10	0 - System Max (Homing speed) 0 - System Max (Max. velocity) 0 - System Max (Jogging speed) 0 - System Max (Rapid jogging speed)
VisualTRANS	S-0-0041 A-0-0020 A-0-0312 A-0-0026	Same as above
Serial Protocol	DP d.41 AP a.20 AP a.312 AP a.26	Same as above
		Default: 0

The values entered in this parameter will be used as the speeds for the various functions specified.

Homing Speed: The speed specified here will be the speed used for Homing if an axis has not already been Homed. If no speed is programmed in a Homing block, the value in this parameter will be the default feedrate.

Maximum Speed: This will be the maximum speed that can be programmed in any programming block. Also, if G00 (Rapid) is chosen as the speed for a program block function, the speed entered here will be the speed used for that block.

Note that drive parameter S-0-0091 (Bipolar Velocity Limit Value) is determined by the maximum speed of the motor and any limitations due to the mechanical characteristics of the axis. The value of Maximum Speed in Aa10 should be set to a value less than the speed corresponding to the Bipolar Velocity Limit configured in the drive. If the Maximum Speed is set higher than the limit set by the Bipolar Velocity Limit Value, it would be possible to program a speed higher than the drive is allowed to go. This would result in an "Excessive Position Command Difference" error (error 37 in DIAX02, F2-37 in DIAX03, F237 in DIAX04).

Slow Jog: This will be the speed used when the TRANS 01-D jogs this axis in Hand mode. The value entered here cannot exceed the Rapid speed or the Rapid Jog value or an error will result.

Rapid Jog: This will be the speed used when the TRANS 01-D is set to rapid jog this axis in Hand mode. The value entered here cannot exceed the Rapid speed or an error will result. The axis must be Homed before this function can be used. If the axis has not been homed, trying to Rapid Jog the axis will not be possible.

Enter the values to be used for this parameter. Press ENTER when all data is confirmed and the TRANS 01-D will store the data for this parameter and step to the next parameter.

Tip: If you make a mistake entering a value within this parameter, press the ESC key on the CTA10-1 and enter the correct value. However; if you realize that you entered an incorrect value after pressing ENTER and proceeding to the next parameter, use the down arrow to return to the previous parameter, press ENTER and correct any errors.

Aa11 Directions

```
A a 1 1   D i r e c t i o n s
P r o g r a m             n
J o g g i n g             n
H o m i n g               n
```

n - Enter a 1 or a 0 to select the direction for the specified function. See note below for Rotary operation.

Access Method	Identification	Permissible Values
CTA10-1 or BTC06-1	Aa11	0 (CW) or 1(CCW) program direction jogging direction homing direction
VisualTRANS	A-0-0309 A-0-0310 A-0-0305	Same as above
Serial Protocol	AP a.309 AP a.310 AP a.305	Same as above
		Default: 0

The programmer will have the ability to select more than one option under this parameter. When you are at the option you want to enable, enter a 0 or a 1.

The direction of the motion can be changed here by toggling between 0 and 1. With a motion commanded in the positive direction (0), the TRANS 01-D will cause the motor to turn in a clockwise direction, when looking at the front of the motor shaft. If another direction is needed for any of the above functions, the direction change must be made here.

Note: When operating in Rotary mode, placing a 0 or a 1 here will Home the axis in the specified direction only. Placing a 2 here will cause the unit to always Home using the **shortest path** to Home. This will cause the axis to Home in either direction, depending on its position.

Pressing the ENTER key will step to the next parameter option.

Enter the values to be used for this parameter. Press ENTER when all data is confirmed and the TRANS 01-D will store the data for this parameter and step to the next parameter.

Tip: If you make a mistake entering a value within this parameter, press the ESC key on the CTA10-1 and enter the correct value. However; if you realize that you entered an incorrect value after pressing ENTER and proceeding to the next parameter, use the down arrow to return to the previous parameter, press ENTER and correct any errors.

Aa12 Homing Reference

```
Aa12 Homing
   Reference
→1.Switch/Mpulse
 2.Switch
```

```
Aa12 Homing
   Reference
 3.Marker Pulse
 4.To Pos.Stop
```

Press the number key or use the up and down arrows to move the arrow to the referencing method you want to use for this axis.

Access Method	Identification	Permissible Values
CTA10-1 or BTC06-1	Aa12	1 (home to marker pulse and switch) 2 (home to switch) 3 (home to marker pulse) 4 (home to positive stop)
VisualTRANS	A-0-0306	Same as above
Serial Protocol	AP a.306	Same as above
		Default: none

The user has the option of using the Marker pulse, the Home switch, both the Marker and the Switch or a Positive Stop as the machine Home reference point. When the TRANS 01-D is commanded to Home an axis (G74), the Homing sequence used is the sequence pre-defined in the digital drive. The Home position is determined by the drive and relayed to the TRANS 01-D via the SERCOS channel. For a full explanation of the Homing routine, please refer to the appropriate application manual for the connected digital drive.

Switch and Marker Pulse

When using the switch and marker pulse, the Home position will be the first marker pulse encountered after the Home switch is made

Marker Pulse

When using marker pulse, the axis will home to the first marker pulse it encounters after it receives the Home input (or Reverse in Manual mode).

Switch

When using switch, the TRANS 01-D will Home to the first switch input it sees. The position at which it saw the switch will be considered Home.

Note: **Homing to a switch is not available** when using an Absolute Encoder for positioning (while absolute feedback is enabled).

Home to a Positive Stop

When a G69 command is programmed in the Homing block, the TRANS 01-D will execute a feed to a positive stop to an incremental programmed distance. If the incremental distance is reached, the TRANS 01-D will issue a “Positive "Stop Missing” diagnostic. If the positive stop is encountered correctly, the TRANS 01-D will move away from the Positive stop the distance entered in Parameter Ax22 (Home to Stop Distance) and declare that position to be Home (machine zero). For a full explanation of this feature, please see the Homing Section in the Programming chapter.

Note: Homing to a Positive Stop is only available on systems that use absolute feedback devices.

After selecting your option, the TRANS 01-D will store this setting and step ahead to the next parameter.

Aa13 Reference Position

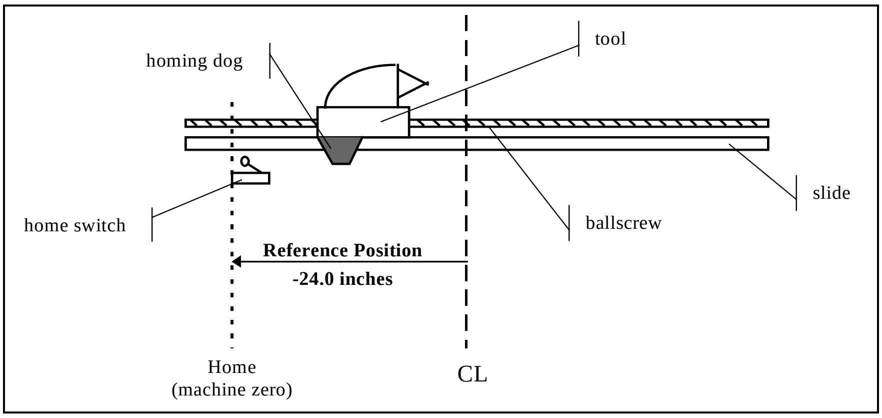
```
Aa13 Reference
     Position
     nnnnnn (UM)
```

nnnnnn - Enter the position you want to use as your Home reference position.

UM - The unit of measure chosen in Parameter Aa02 will be displayed here for the programmers reference. This is displayed for reference only and cannot be changed in this parameter. The units can only be changed in Parameter Aa02

Access Method	Identification	Permissible Values
CTA10-1 or BTC06-1	Aa13	0 - max. system travel distance
VisualTRANS	A-0-0318	Same as above
Serial Protocol	AP a.318	Same as above
		Default: 0

In many cases, some position other than the home position, such as the centerline of the slide, is used as the reference position (as shown in the following diagram). All programmed distances are then specified in reference to this point. Enter either 0 or the distance from Home to the location to be used as the reference position into this parameter, positive or negative. The value entered into this parameter will be summed with the value in the Homing block axis word. At the end of the Drive Controlled Homing procedure, this value will be displayed.



Entering a value in this parameter will not cause any motion at the end of the Homing cycle. Only the position displayed will change.

Enter the value to be used for this parameter. Press ENTER when all data is confirmed and the TRANS 01-D will store the data for this parameter and step to the next parameter. If you make a mistake entering this value, press the ESC key and enter the correct value.

Aa14 Overload Factor

This Overload Factor parameter is only available when using DIAX02 (DDS02.1, DDS03.1, etc.) digital drives. However, when using a DIAX03 (DDS02.2, DDS03.2, etc.) or DIAX04 (HDD, HDS, etc.) digital drive, the Overload Factor is controlled and monitored by the drive. This parameter will still be displayed by the CTA10-1 but a second screen ("Not available for this Drive") will be displayed after pressing ENTER.

```
Parameter Number
For a-Axis(0-34)
 Aa#=  14
:Overload Factor
```

Second screen displayed for DIAX02 Digital Drives

```
Aa14 Overload
     Factor %
     nnnn
```

Second screen displayed for DIAX03 / 04 Digital Drives

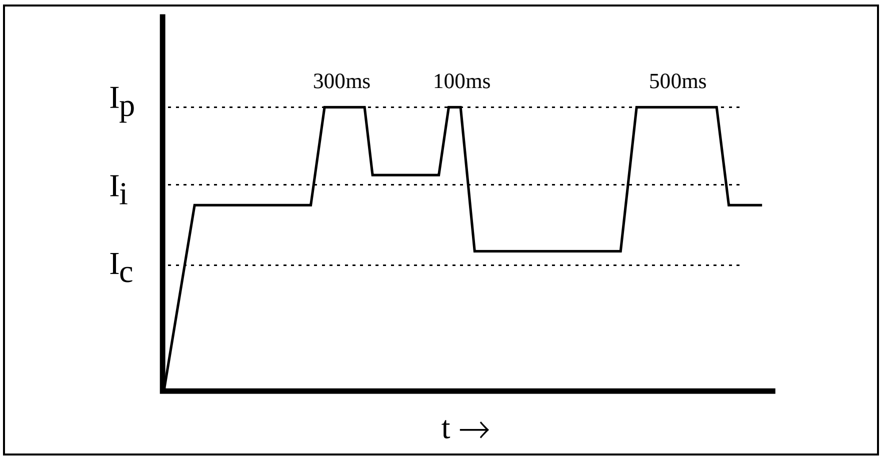
```
Not available
for this Drive
```

nnnn - Enter the percentage value for the Overload Factor you want to use for this axis.

Access Method	Identification	Permissible Values
CTA10-1 or BTC06-1	Aa14	1 - 65535
VisualTRANS	P-0-0006	Same as above
Serial Protocol:	DP d.32774	Same as above
		Default: 100%

This parameter sets the allowable intermittent current (and torque) range of the servo system.

There are three important **current** levels to consider, continuous, intermittent, and peak. Theoretically, peak current is dependent upon the drive selection and should be available for 300 - 500 msec. However under load, the time that may be spent at peak current is affected by the intermittent current level and the switch-on time above or below this level: the more time spent above intermittent current level, the less time is available at peak current. Conversely, the more time spent below the intermittent current level, the more time is available at peak current. Also, the higher the intermittent current level, the less time available for peak current.



Time spent at peak current is limited because there is a limit to the drive's ability to dissipate heat. Thus generally speaking, according to the following equation:

Intermittent Current = Continuous Current x Overload Factor

the higher the overload factor, the lower the maximum available **torque** (which is dependent upon available peak current).

For more information on these relationships, refer to the DDS 2.10 SERCOS Drive Application Manual.

Enter the value to be used for this parameter. Press ENTER when all data is confirmed and the TRANS 01-D will store the data for this parameter and step to the next parameter. If you make a mistake entering this value, press the ESC key and enter the correct value.

Tip: If you make a mistake entering a value within this parameter, press the ESC key on the CTA10-1 and enter the correct value. However; if you realize that you entered an incorrect value after pressing ENTER and proceeding to the next parameter, use the down arrow to return to the previous parameter, press ENTER and correct any errors.

Aa15 Maximum Tool Correction

```
Aa15 Maximum
Tool Correction
     n.nnnn (UM)
```

nnnnnn - Enter the value to be used as the maximum allowable Tool Correction value.

UM - The unit of measure chosen in Parameter Aa02 will be displayed here for the programmer's reference. This is displayed for reference only and cannot be changed in this parameter. The units can only be changed in Parameter Aa02

Access Method	Identification	Permissible Values
CTA10-1 or BTC06-1	Aa15	0 - 99
VisualTRANS	A-0-0307	Same as above
Serial Protocol	AP a.307	Same as above
		Default: 0 in. or 0 mm.

Note that prior to TRANS 01-D firmware release 06V42, the largest permissible value to which this Maximum Tool Correction parameter could be set was 30 (corresponding to 30 inches or 30 mm).

This parameter limits the maximum programmable values for tool correction. This parameter is valid for both manual correction values and the external correction value. Entering correction values larger that this maximum results in an Immediate Stop condition in the part program at the point where the correction value was to be used. The "Maximum Tool Correction Exceeded" diagnostic message will be displayed on the CTA10-1.

Enter the value to be used for this parameter. Press ENTER when all data is confirmed and the TRANS 01-D will store the data for this parameter and step to the next parameter. If you make a mistake entering this value, press the ESC key and enter the correct value.

Tip: If you make a mistake entering a value within this parameter, press the ESC key on the CTA10-1 and enter the correct value. However; if you realize that you entered an incorrect value after pressing ENTER and proceeding to the next parameter, use the down arrow to return to the previous parameter, press ENTER and correct any errors.

Aa16 Axis AF Switching

```
Aa16 Axis
AF Switching
→1.Disable
 2.Enable
```

Press the number key or use the up and down arrows to move the arrow to disable or enable AF switching. Parameters that are listed with a number can be select by the numerical keypad on the CTA10-1 or by using the up and down arrows.

Access Method	Identification	Permissible Values
CTA10-1 or BTC06-1	Aa16	1 (disabled) 2 (enabled)
VisualTRANS	A-0-0308	0 (disabled) 1 (enabled)
Serial Protocol	AP a.308	Same as above
		Default: disabled

This parameter gives the user the ability to program the axis to disable the **current flow** to the motor of a servo drive during a user program. It is used most often on rotary tables, where it is necessary to disable the motor while the table is **clamped**. During this condition, the display on the digital drive will change from AF to Ab.

When your selection is entered, the TRANS 01-D will store the option and automatically step to the next parameter.

See the Section on Programming for a full description on the Axis AF Switching commands.

Aa17 Control Windows

```
Aa17A Control
     Windows
Position Window
 nnnnnn.nn  (UM)
```

```
Aa17B ControlWin
MaxDev n.nnnn
Monitoring Wind
       nnnn.nnn
```

```
Aa17C ControlWin
Zero VelocIty
WIndow %
   nn.nnn     UM
```

nnnnnn.nn - Enter the values to be used for determining your In-position Window.

nnnn.n% **-** Enter the value to be used for your Velocity Loop Monitoring percentage.

UM - The unit of measure chosen in Parameter Aa02 will be displayed here for the programmer's reference. This is displayed for reference only and cannot be changed in this parameter. The units can only be changed in Parameter Aa02

Access Method	Identification	Permissible Values
CTA10-1 or BTC06-1	Aa17	0 - 214748.3647 (In-Position Window) 0 - 6553.5 (Monitoring Window)
VisualTRANS	S-0-0057 S-0-0159	Same as above
Serial Protocol	DP d.57 DP d159	Same as above
		Default: *0.001 (In-Position Window)* *10% (Monitoring Window)*

Position Window: When the axis position is found to be within the limits defined by this parameter, it is considered to be "in position" and the drive will acknowledge.

Monitoring Window: The maximum following error which is allowed by the position loop can be defined in the monitoring window. When the position error exceeds the maximum window value, the drive sets an excessive position error in Class 1 Diagnostics, IDN S-0-0011.

This is also shown on the H1 display as a "28" error, Excessive Deviation. When this error occurs, the maximum deviation which was encountered is stored in parameter P-0-0098 in percent, with 100% = 360.

A procedure for setting this parameter is as follows:

1. Set this parameter (S-0-0159, Monitoring Window) to 50%.
2. Run the axis with its maximum velocity and acceleration for the application.
3. Read the maximum model deviation from IDN P-0-0098.
4. Multiply the max. model deviation by 2 and enter into parameter S-0-0159.

Zero Velocity Window: This window sets a minimum velocity in which the motor operates. If the motor operates below this value, it is considered to be a zero velocity.

Aa18 External Encoder Control Window

```
Aa18 Ext.Encoder
Control Windows
    (UM)
     n.nnnn
```

nnnn - Enter the value to be used for the maximum position difference to be allowed. Leaving the value of this parameter at 0.0000 disables the monitoring function.

Access Method	Identification	Permissible Values
CTA10-1 or BTC06-1	Aa18	0 - 214748.3647
VisualTRANS	P-0-0120	Same as above
Serial Protocol	DP d.32888	Same as above
		Default: 0.0

When an external encoder is connected to the digital servo drive and used as the primary positioning device, the Indramat servo drive constantly monitors the difference between the external encoder position and the motor encoder position for an additional error check on the machine mechanics. This monitoring is designed to show that the relationship between the motor encoder and the external encoder has changed. If the position difference between these two encoders exceeds this value, the digital drive will issue a “36” error. The error will alert the user to this condition. The cause of the difference can be loose mechanics or a slipping drive belt.

Enter the value to be used for this parameter. Press ENTER when all data is confirmed and the TRANS 01-D will store the data for this parameter and step to the next parameter. If you make a mistake entering this value, press the ESC key and enter the correct value.

Tip: If you make a mistake entering a value within this parameter, press the ESC key on the CTA10-1 and enter the correct value. However; if you realize that you entered an incorrect value after pressing ENTER and proceeding to the next parameter, use the down arrow to return to the previous parameter, press ENTER and correct any errors.

Aa19 Deactivate Absolute Encoder Function

```
Aa19 Deactivate
Absolute Encoder
Function
                n
```

n - Enter a 0 here to disable this function. Entering a 1 will enable this function.

Access Method	Identification	Permissible Values
CTA10-1 or BTC06-1	Aa19	0 (disabled) 1 (enabled)
VisualTRANS	P-0-0138	Same as above
Serial Protocol	DP d.32906	Same as above
		Default: disabled

When an Indramat digital servo drive is connected to a motor with a Multi-turn absolute feedback, the user may want to disable the absolute function and use the motor as if it was configured with a single-turn feedback. Entering a 1 in this parameter will cause the servo drive to operate as if it was connected to a motor with a single turn feedback. In this configuration, when power is applied to the system, the axis will have to be referenced before any program can be executed,

If this parameter is set to a 0 (default), the motor-drive system will operate as originally configured.

Note: This parameter is only effective on servo systems that have a multi-turn absolute feedback mounted on the servo motor. This parameter will be displayed but is not functional on a system that has a single turn feedback installed.

Enter the value to be used for this parameter. Press ENTER when all data is confirmed and the TRANS 01-D will store the data for this parameter and step to the next parameter. If you make a mistake entering this value, press the ESC key and enter the correct value.

Tip: If you realize that you entered an incorrect value after pressing ENTER and proceeding to the next parameter, use the down arrow to return to the previous parameter, press ENTER and correct any errors.

Aa20 Maximum Speed to Positive Stop

```
Aa20 Max.Speed
To Positive Stop
    nnnnn (UM)
```

nnnnn - Enter the maximum speed to be used when feeding to the positive stop

UM - The units of measure chosen in Parameter Aa02 will be displayed here for the programmer's reference. This is displayed for reference only and cannot be changed in this parameter. The units can only be changed in Parameter Aa02

Access Method	Identification	Permissible Values
CTA10-1 or BTC06-1	Aa20	0 - System Max.
VisualTRANS	A-0-0313	Same as above
Serial Protocol	AP a.313	Same as above
		Default: 0

When feeding to a positive stop, it is recommended that it be done at a reduced feedrate. This prevents hitting the stop at too high a speed. The value entered here will be used as the maximum feedrate that can be programmed in a block using the G75 or G69 command. If a value greater that this parameter is entered in the user program, an error will occur before the block is executed.

Enter the value to be used for this parameter. Press ENTER when all data is confirmed and the TRANS 01-D will store the data for this parameter and step to the next parameter. If you make a mistake entering this value, press the ESC key and enter the correct value.

Tip: If you make a mistake entering a value within this parameter, press the ESC key on the CTA10-1 and enter the correct value. However; if you realize that you entered an incorrect value after pressing ENTER and proceeding to the next parameter, use the down arrow to return to the previous parameter, press ENTER and correct any errors.

Aa21 Positive Stop Torque %

```
Aa21 Positive
Stop Torque %
To Stop:nnn.n%
```

nn - Enter the value, in percentage of maximum, for the selected torque to be used when feeding the axis to a positive stop.

% - The values entered above are a percentage of maximum. Parameter Aa07 Bipolar Torque Limit value entered into the digital drive is the maximum value the drive will allow. Refer to page 3-39.

Access Method	Identification	Permissible Values
CTA10-1 or BTC06-1	Aa21	0 - 400%
VisualTRANS	A-0-0314 A-0-0315	Same as above
Serial Protocol	AP a.314 AP a.315	Same as above
		Default: 0

When an axis is feeding to a positive stop, it is recommended that the speed and torque of the servo system be reduced in the motion block during which the axis will encounter the stop. This will reduce the stress on the system mechanics. "To Stop _ _ _%" is the reduced torque value to be used when the stop is encountered.

After the stop has been encountered, the torque should be reduced again to avoid holding against the stop with excessive torque. "At Stop _ _ _ %" is the torque value to be used when up against the stop. Typically the torque used against the stop is the amount of torque necessary to overcome any cutting thrust and wind-up in the system.

Enter the value to be used for this parameter. Press ENTER when all data is confirmed and the TRANS 01-D will store the data for this parameter and step to the next parameter. If you make a mistake entering this value, press the ESC key and enter the correct value.

Tip: If you make a mistake entering a value within this parameter, press the ESC key on the CTA10-1 and enter the correct value. However; if you realize that you entered an incorrect value after pressing ENTER and proceeding to the next parameter, use the down arrow to return to the previous parameter, press ENTER and correct any errors.

Aa22 Home to Stop Distance

```
Aa22 Home to Pos
 Stop Distance
      n.n (UPM)
```

n.n - Enter the distance to move after the positive stop has been encountered.

Access Method	Identification	Permissible Values
CTA10-1 or BTC06-1	Aa22	0 - max. distance allowed by travel limits
VisualTRANS	A-0-0323	Same as above
Serial Protocol	AP a.323	Same as above
		Default: 0.0

This parameter defines the distance the axis should move away from the positive stop in a Homing to a Positive Stop (G69) command block. This value should not contain polarity, as the direction will always be the opposite of Axis Parameter Aa11 Directions, value. Refer to page, 3-44.

In the G69 -Home to Positive Stop function, after the move to the positive stop indicates that the positive stop has been found, the value in this parameter will be commanded as an incremental move away from the positive stop.

Enter the value to be used for this parameter. Press ENTER when all data is confirmed and the TRANS 01-D will store the data for this parameter and step to the next parameter. If you make a mistake entering this value, press the ESC key and enter the correct value.

Tip: If you make a mistake entering a value within this parameter, press the ESC key on the CTA10-1 and enter the correct value. However; if you realize that you entered an incorrect value after pressing ENTER and proceeding to the next parameter, use the down arrow to return to the previous parameter, press ENTER and correct any errors.

Aa30 Maximum Speed for Adaptive Depth (currently reads Options)

```
Aa30 Options
Adaptive Depth
     nn.n   (UM)
```

nn.n - Enter the maximum speed to be used for the execution of a G08 Adaptive Depth Control.

UM - The units of measure chosen in Parameter Aa02 will be displayed here for the programmer's reference. This is displayed for reference only and cannot be changed in this parameter. The units can only be changed in Parameter Aa02

Note: This parameter is only functional for the Adaptive Depth program block. It is disabled for standard linear scale operation.

Access Method	Identification	Permissible Values
CTA10-1 or BTC06-1	Aa30	0 - value in Axis Parameter Aa10, Maximum Speed, page 3-45.
VisualTRANS	A-0-0317	Same as above
Serial Protocol	AP a.317	Same as above
		Default: 0.0

When the user has set up their TRANS 01-D system for Adaptive Depth, the value entered in this parameter will be the maximum allowable program speed to be used in the adaptive depth (G08) program block. If the speed programmed in the block exceeds this value, the error "780: Maximum Adaptive Depth feedrate exceeded" will result.

Enter the value to be used for this parameter. Press ENTER when all data is confirmed and the TRANS 01-D will store the data for this parameter and step to the next parameter. If you make a mistake entering this value, press the ESC key and enter the correct value.

Tip: If you make a mistake entering a value within this parameter, press the ESC key on the CTA10-1 and enter the correct value. However; if you realize that you entered an incorrect value after pressing ENTER and proceeding to the next parameter, use the down arrow to return to the previous parameter, press ENTER and correct any errors.

Aa31 Linear Encoder Pre-Limit

```
Aa31 Linear Enc.
Pre-Limit
     nn.n   (UM)
```

nnnnn - Enter in the minimum amount of deflection.

UM - The units of measure chosen in Parameter Aa02 will be displayed here for the programmer's reference. This is displayed for reference only and cannot be changed in this parameter. The units can only be changed in Parameter Aa02

Note: This parameter is only functional for the Adaptive Depth program block. It is disabled for standard linear scale operation.

Access Method	Identification	Permissible Values
CTA10-1 or BTC06-1	Aa31	0 - 2 inches or 50 mm
VisualTRANS	A-0-0311	Same as above
Serial Protocol	AP a.311	Same as above
		Default: 0.0

When Adaptive Depth is configured, the TRANS 01-D will monitor the deflection on the linear encoder before it begins to execute the G08 program block. The value entered in this parameter is the minimum amount of deflection that must be seen on the external scale before the G08 program block is executed. This parameter can be used as a part location monitor.

If the value in this parameter is not reached before the execution of the G08 block, the error "511: Adaptive Depth Pre-Limit Error" will be issued.

Enter the value to be used for this parameter. Press ENTER when all data is confirmed and the TRANS 01-D will store the data for this parameter and step to the next parameter. If you make a mistake entering this value, press the ESC key and enter the correct value.

Tip: If you make a mistake entering a value within this parameter, press the ESC key on the CTA10-1 and enter the correct value. However; if you realize that you entered an incorrect value after pressing ENTER and proceeding to the next parameter, use the down arrow to return to the previous parameter, press ENTER and correct any errors.

Aa32 Linear Encoder Maximum Deflection

```
Aa32 Linear Enc.
Max.Deflection
     nn.n  (UM)
```

nn.n - Enter in the maximum deflection allowed.

UM - The units of measure chosen in Parameter Aa02 will be displayed here for the programmer's reference. This is displayed for reference only and cannot be changed in this parameter. The units can only be changed in Parameter Aa02

Note: This parameter is only functional for the Adaptive Depth program block. It is disabled for standard linear scale operation.

Access Method	Identification	Permissible Values
CTA10-1 or BTC06-1	Aa32	0 - 2 inches or 50 mm
VisualTRANS	A-0-0316	Same as above
Serial Protocol	AP a.316	Same as above
		Default: 0.0

When the TRANS 01-D is configured for Adaptive Depth, this parameter sets the maximum allowable deflection on the external linear scale. If this value is exceeded in a G08 program block, the error "781: Maximum Adaptive Depth deflection exceeded" will be issued. The value entered into this parameter should be the maximum distance the scale can be deflected without causing damage to the machine, tooling or the linear scale.

If the user programs a position that will take the unit outside of this value, the same error will be issued.

Enter the value to be used for this parameter. Press ENTER when all data is confirmed and the TRANS 01-D will store the data for this parameter and step to the next parameter. If you make a mistake entering this value, press the ESC key and enter the correct value.

Tip: If you make a mistake entering a value within this parameter, press the ESC key on the CTA10-1 and enter the correct value. However; if you realize that you entered an incorrect value after pressing ENTER and proceeding to the next parameter, use the down arrow to return to the previous parameter, press ENTER and correct any errors.

Aa33 Linear Encoder Resolution

```
Aa33 Linear Enc.
Resolution
    nn.n  (UM)
```

nn.n - Enter the resolution of the external linear scale in reference to the unit of measure in parameter Aa02.

Access Method	Identification	Permissible Values
CTA10-1 or BTC06-1	Aa33	0 - 21474.83647
VisualTRANS	S-0-0118	Same as above
Serial Protocol	DP d.118	Same as above
		Default: 0.0

When the TRANS 01-D is configured for Adaptive Depth, this parameter sets the resolution of the external linear scale.

Note: Linear Encoder resolution specifications are usually contained in the manufacturer's documentation. It may also be contained in the machine documentation. Please consult this documentation or call the Indramat Service Hotline at 800-860-1055.

Entering an incorrect value here will cause intermittent positioning errors and mis-positioning of the axis when executing the G08 program block.

To determine if the value entered in this parameter is correct, mark off a known distance on the machine slide and jog the axis that distance. Compare the actual slide position with the marks to verify that the correct distance was traversed.

Enter the value to be used for this parameter. Press ENTER when all data is confirmed and the TRANS 01-D will store the data for this parameter and step to the next parameter. If you make a mistake entering this value, press the ESC key and enter the correct value.

Tip: If you make a mistake entering a value within this parameter, press the ESC key on the CTA10-1 and enter the correct value. However; if you realize that you entered an incorrect value after pressing ENTER and proceeding to the next parameter, use the down arrow to return to the previous parameter, press ENTER and correct any errors.

Aa34 Linear Encoder Direction

```
Aa34 Linear Enc.
Direction

               n
```

n - Enter the direction polarity for the external linear scale. Enter a 0 for positive and a 1 for negative.

Access Method	Identification	Permissible Values
CTA10-1 or BTC06-1	Aa34	0 (positive) 1 (negative)
VisualTRANS	S-0-0115	bit 4 = 0, i.e., 0000000000000xxx (positive) bit 4 = 1, i.e., 0000000000001xxx (negative)
Serial Protocol	DP d.115	Same as above
		Default: positive

When the TRANS 01-D is configured for Adaptive Depth, this parameter determines which direction the external scale will travel for increasing or decreasing its position relative to the movement of the slide. If set to 0, further deflection of the scale will cause the position value to increase in the positive direction. If 1 is entered, further deflection of the scale will cause the position value to increase in the negative direction.

Note: To determine if the direction is entered correctly in this parameter, set a small value in Aa18 External Encoder Control Window and jog the slide with the external encoder deflected. If the direction is incorrect, the drive will issue a 36 error.

3.4 Spindle Parameters for DIAX01 Digital Drives

```
DIAX01 Spd Param
1.P-set
2.Q-set
3.R-set
```

```
Sx00 Select
4.S-set
5.General Param
6.Motor Param
```

When a DIAX01 (TDA, KDA or RAC) digital drive is connected to the TRANS 01-D system and used as a spindle drive, the screens shown above will be displayed to allow the user the ability to choose one of the six parameter sets for entering data. The parameter set can be selected by entering the number using the numeric keypad or by using the up and down arrows on the CTA10-1.

User Selectable Parameter (P, Q, R and S) Sets

The User Selectable Parameter sets are programmed by the user to configure the DIAX01 drive to adapt its operation to a particular application. These parameters sets are identified by the letters P, Q, R and S. The User Selectable Parameter sets are designated as SPx, SQx, SRx. And SSx. For additional information on the use of the additional parameter sets, contact an Indramat Applications Engineer.

Note: The only User Selectable Parameter set available for TRANS 01-D firmware version 6VRS is the P set. The TRANS 01-D will default to this set for normal operation.

General Parameter and Motor Parameter Sets

The General Parameters (also referred to as the A parameter set) are used to define operating modes and limits. The General Parameter set is designated as SAx.

The Motor Parameters (also referred to as the M parameter set) are used to define the particular 2AD motor type interfaced with the DIAX01 drive. These parameters are factory set and do not require field (user) modification. The Motor Parameter set is designated as SMx.

After you have chosen the appropriate parameter set, the CTA10-1 will step you through the available parameters for data entry. See the following pages for the descriptions of the various parameters in each parameter set.

Moving the cursor to the desired option or pressing the numerical key associated with the desired option will step the user into the appropriate parameter set. If you make a mistake entering this value, press the ESC key and enter the correct value.

Displaying Spindle Motor/Controller Information

Pressing the right arrow key on the CTA10-1 will also display the spindle controller and spindle motor information, such as drive firmware version and complete type codes. The following screens show how this data is displayed:

```
Controller Type
TDA1.3-100-3-L00
```

```
FW Type Code
11.95 HASE3V07
```

```
Motor Type Code
2AD 132C-B35-0B1
```

```
SERCOS FW Type
V 01.02
```

The values entered into these parameters cannot be changed, except for the Motor Type Code. This value must be entered, as it is not read from the motor itself. The following table shows the locations for the above-mentioned information.

Access Method	Identification	Permissible Values
VisualTRANS	S-0-0140 S-0-0030 S-0-0143 S-0-0141	Controller Type Code Controller Firmware Type Code SERCOS Interface Firmware Version Spindle Motor Type Code
Serial Protocol	DP 4.140 DP 4.30 DP 4.143 DP 4.141	Same as above
		Default: depends on drive system

SP1 Positioning Speeds

```
S P 1   P o s i t i o n i n g
S p e e d s
S p i n d l e     n n n n n n
S e a r c h       n n n n n n
```

nnnnnn - Enter the speed values to be used for the each option.

Access Method	Identification	Permissible Values
CTA10-1 or BTC06-1	SP1	Spindle Positioning Speed Home Switch Search Speed Range depends on drive system
VisualTRANS	A-0-0322 P-0-1215	Same as above
Serial Protocol	AP 4.322 DP 4.33983	Same as above
		Default: 100

Spindle: The user should enter the speed value to be used for positioning the spindle. This value will be the speed used to position the spindle when it is commanded in a program block.

Search: When the “Position to Home Switch” option is selected in SP14, bit 6, this will be the speed used to search for the Home switch.

Enter the values to be used for this parameter. Press ENTER when all data is confirmed and the TRANS 01-D will store the data for this parameter and step to the next parameter.

Tip: If you make a mistake entering a value for an option within this parameter, use the left and right arrow keys on the CTA10-1 and enter the correct value. Using the ESC key will back you up to the previous parameter.

SP2 Control Windows

```
SP2 Control
WIndows
Position    nn.nnn
Monitor     nn.nnn
```

nnnnnn - Enter the position tolerance values to be used for the each option

Access Method	Identification	Permissible Values
CTA10-1 or BTC06-1	SP2	0.1 - 359.9º (Position Window) 0 - 169.9% (Monitoring Window)
VisualTRANS	S-0-0057 S-0-0159	Same as above
Serial Protocol	DP 4.57 DP 4.159	Same as above
		Default: 0.01 (Position Window) 10% (Monitoring Window)

Position Window: The value entered into this parameter sets the tolerance window for the spindle in position output. If the spindle is positioned in a program block, when the position of the spindle is within this distance from the programmed position, the “Spindle In Position” bit will be set high.

Monitor Window: The value entered into this parameter sets the tolerance window for the DEV>MAX error. If the following error (S-0-0189) exceeds the value programmed here, then the drive shuts down issuing the error message “DEV>MAX”. The maximum value of this parameter is 169.9°. If the position loop gain factor = 1, then this corresponds to 470 rpm with following distance in position control. If higher RPMs are needed, then the KV factor parameter (SP03) value must be increased. Position control without following distance is recommended.

Enter the values to be used for this parameter. Press ENTER when all data is confirmed and the TRANS 01-D will store the data for this parameter and step to the next parameter.

Tip: If you make a mistake entering a value for an option within this parameter, use the left and right arrow keys on the CTA10-1 and enter the correct value. Using the ESC key will back you up to the previous parameter.

SP3 KV Factor

```
SP3 KV Factor

      nn.n
```

nn.n - Enter the value to be used as the position loop gain (KV factor) when positioning the spindle.

Access Method	Identification	Permissible Values
CTA10-1 or BTC06-1	SP3	0.1 - 29
VisualTRANS	S-0-0104	Same as above
Serial Protocol	DP 4.104	Same as above
		Default: 1

KV Factor: The position loop gain desired should be entered here. The default value is 1. The KV factor determines the gain of the position loop regulator throughout the entire velocity range. This parameter can be used to regulate the “stiffness” of the system when positioning the spindle.

Enter the value to be used for this parameter. Press ENTER when the data is confirmed and the TRANS 01-D will store the data for this parameter and step to the next parameter.

Tip: If you make a mistake entering a value for an option within this parameter, use the left and right arrow keys on the CTA10-1 and enter the correct value. Using the ESC key will back you up to the previous parameter.

SP4 Bipolar Velocity Limit

```
SP4 Bi-Polar
Velocity Limit
  nnnnn.nnnn
```

nnnnnn - Enter the value to be used as the bipolar velocity limit for the spindle drive.

Access Method	Identification	Permissible Values
CTA10-1 or BTC06-1	SP4	0 - 10,000 rpm
VisualTRANS	S-0-0091	Same as above
Serial Protocol	DP 4.91	Same as above
		Default: depends on drive system

If the gear ratio parameter SP5 has been properly set, then the bipolar velocity command value is limited to this value and the spindle can never turn faster. S-0-0091 (bipolar velocity limit) always relates to the load. If a gear ratio has been input, then set S-0-0091 so that the maximum speed of the motor (SA1) is not exceeded.

Example: If the spindle motor has a maximum speed of 6000 rpm in parameter SA1 and the gear ration (SP5) is set to 1:1, then the bipolar velocity limit (SP4) can be set to a max of 6000 rpm. However, for the same setting of SA1 of 6000 rpm and a gear ratio (SP5) of 2:1, then the max bipolar velocity should not exceed 3000 rpm.

Enter the value to be used for this parameter. Press ENTER when the data is confirmed and the TRANS 01-D will store the data for this parameter and step to the next parameter.

Tip: If you make a mistake entering a value for an option within this parameter, use the left and right arrow keys on the CTA10-1 and enter the correct value. Using the ESC key will back you up to the previous parameter.

SP5 Gear Ratio

```
SP5 Gear Ratio

 Input REV     nnn
Output REV     nnn
```

nnn - Enter the input and output revolution values for the gear ratio.

Access Method	Identification	Permissible Values
CTA10-1 or BTC06-1	SP5	1 - 9999 rpm (Input Revolutions) 1 - 9999 rpm (Output Revolutions)
VisualTRANS	S-0-0121 S-0-0122	Same as above
Serial Protocol	DP 4.121 DP 4.122	Same as above
		Default: 1:1

The value of any gear ratio in the spindle system is entered here. This parameter does not allow any decimal points. It does allow for up to four digits as the gear ratio.

If a second encoder is not used or speed limits are not under consideration, it is not necessary to program a gear ratio, even if one is being used.

Enter the values to be used for this parameter. Press ENTER when the data is confirmed and the TRANS 01-D will store the data for this parameter and step to the next parameter.

Tip: If you make a mistake entering a value for an option within this parameter, use the left and right arrow keys on the CTA10-1 and enter the correct value. Using the ESC key will back you up to the previous parameter.

SP6 Thresholds

```
SP6  Thresholds

Torque       nnnnn
Power        nnnn
```

nnnnnn - Enter the numerical value for the data.

Access Method	Identification	Permissible Values
CTA10-1 or BTC06-1	SP6	1 - 100 % (Torque Threshold) 1000 - 127000 W (Power Threshold)
VisualTRANS	S-0-0126 S-0-0158	Same as above
Serial Protocol	DP 4.126 DP 4.158	Same as above
		Default: 100% (Torque Threshold) 1000 W (Power Threshold)

Torque Threshold

The required torque threshold value is entered here (specified in %). The smoothed torque actual value is checked in the drive as to whether it has exceeded this value. Torque is not limited. If the threshold is exceeded, bit #3 of S-0-0013 (class 3 diagnostics), is set to 1, and, once the value drops below the threshold, cleared. This bit is not currently monitored by the TRANS 01-D.

Power Threshold

The value of the power threshold is set here (specified in Watts). The DC bus output is checked in the drive as to whether it has exceeded this value. The output is not limited. If the threshold is exceeded, then bit #7 of S-0-0013 (class 3 diagnostics), is set to 1, and, once the value drops below the threshold, cleared. This bit is not currently monitored by the TRANS 01-D. S-0-158 corresponds, with restrictions, to parameter P,Q,R,S-19 (LOAD-LIM) in conventional main spindle drives. See applications description of AC main spindle drives for functional description and programming.

Enter the values to be used for this parameter. Press ENTER when the data is confirmed and the TRANS 01-D will store the data for this parameter and step to the next parameter.

Tip: If you make a mistake entering a value for an option within this parameter, use the left and right arrow keys on the CTA10-1 and enter the correct value. Using the ESC key will back you up to the previous parameter.

SP7 Ramp - RPM1

```
SP7 Ramp - RPM1
Ramp1      nnn
RPM1       nnnnn
```

nnnnnn - Enter the numerical value for the data.

Access Method	Identification	Permissible Values
CTA10-1 or BTC06-1	SP7	0 - 999 rad/s^2 (Ramp 1) 0 - 30,000 rpm (RPM 1)
VisualTRANS	P-0-1201 P-0-1202	Same as above
Serial Protocol	DP 4.33969 DP 4.33970	Same as above
		Default: 0 (Ramp 1) *1 (RPM 1)*

Ramp1 sets the acceleration and deceleration ramp to be used between zero speed and the speed value programmed in RPM 1. Normally, Ramp 1 is used to reduce acceleration rates near zero to soften forces on the drive train during start/stops and direction reversals.

CAUTION: If one of the three ramps (Ramp 1, Ramp 2 or Ramp 3) is programmed with 0 (zero) for maximum acceleration, the other two ramps will be ignored and the acceleration and deceleration rates will be the maximum, limited by the peak current rating of the drive.

Enter the values to be used for this parameter. Press ENTER when the data is confirmed and the TRANS 01-D will store the data for this parameter and step to the next parameter.

Tip: If you make a mistake entering a value for an option within this parameter, use the left and right arrow keys on the CTA10-1 and enter the correct value. Using the ESC key will back you up to the previous parameter.

SP8 Ramp - RPM2

```
SP8 Ramp - RPM2
Ramp2      nnn
RPM2       nnnnn
```

nnnnnn - Enter the numerical value for the data.

Access Method	Identification	Permissible Values
CTA10-1 or BTC06-1	SP8	0 - 999 rad/s^2 (Ramp 2) 0 - 30,000 rpm (RPM 2)
VisualTRANS	P-0-1203 P-0-1204	Same as above
Serial Protocol	DP 4.33971 DP 4.33972	Same as above
		Default: 0 (Ramp 2) *1 (RPM 2)*

Ramp 2 is active for acceleration and deceleration between RPM 1 and RPM 2. Ramp 2 can be used to produce a higher ramp rate than that set in Ramp 1 and is normally used up to base speed of the motor to produce a high accel/decel rate in the constant torque region.

RPM 2 sets the upper limit for Ramp 2.

Enter the values to be used for this parameter. Press ENTER when the data is confirmed and the TRANS 01-D will store the data for this parameter and step to the next parameter.

Tip: If you make a mistake entering a value for an option within this parameter, use the left and right arrow keys on the CTA10-1 and enter the correct value. Using the ESC key will back you up to the previous parameter.

SP9 Ramp - RPM3

```
SP9 Ramp - RPM3

        nnn
```

nnn - Enter the numerical value for the data.

Access Method	Identification	Permissible Values
CTA10-1 or BTC06-1	SP9	0 - 999 rad/s^2 (Ramp 3)
VisualTRANS	P-0-1205	Same as above
Serial Protocol	DP 4.33973	Same as above
		Default: 0

Ramp 3 is active for acceleration and deceleration from RPM 2 to the maximum speed of the motor (Parameter SA1). Ramp 3 can be used to reduce accel/decel rates in the constant horsepower range (from base speed to maximum speed) or to minimize overshooting at the command speed..

Enter the value to be used for this parameter. Press ENTER when the data is confirmed and the TRANS 01-D will store the data for this parameter and step to the next parameter.

Tip: If you make a mistake entering a value for an option within this parameter, use the left and right arrow keys on the CTA10-1 and enter the correct value. Using the ESC key will back you up to the previous parameter.

SP10 Gain 1

```
SP10  Gain1

P-Gain1        nnnn
I-Gain1        nnnn
```

nnnn - Enter the numerical value for the data.

Access Method	Identification	Permissible Values
CTA10-1 or BTC06-1	SP10	0 - 9.99 (P-Gain 1) 0 - 9.99 (I-Gain 1)
VisualTRANS	P-0-1207 P-0-1208	Same as above
Serial Protocol	DP 4.33975 DP 4.33976	Same as above
		Default: depends on motor/drive combo

P-Gain 1: This parameter is the proportional gain of the speed regulator below GAIN RPM (Parameter Sx12). Normally, this value should not require alteration in the field. The linear torque producing characteristics of the drive's velocity loop is controlled by the P-Gain. The P-Gain controls a percentage of torque that is generated by the drive when it detects a difference between the commanded speed versus the actual speed of the motor. If different velocity loop characteristics are desired, this parameter can be used to control the proportional section of the loop, and normal velocity loop principles apply.

I - Gain 1: This parameter defines the integral gain of the speed regulator below GAIN RPM (Parameter Sx12). The I-Gain controls the torque producing rate characteristics of the drive's velocity loop. The I-Gain influences a rate of torque generated by the drive when it detects a difference between the commanded speed vs. the actual speed of the motor. Higher I-Gain values translate to a quicker response in the drive's velocity loop to generate torque. The characteristics of the drive/motor combination are carefully analyzed to determine the best value to be set in this parameter so that this value should not require alteration in the field. If different velocity loop characteristics are desired, this parameter can be used to control the integral section of the loop and normal velocity loop principles apply.

Enter the values to be used for this parameter. Press ENTER when the data is confirmed and the TRANS 01-D will store the data for this parameter and step to the next parameter.

Tip: If you make a mistake entering a value for an option within this parameter, use the left and right arrow keys on the CTA10-1 and enter the correct value. Using the ESC key will back you up to the previous parameter.

SP11 Gain 2

```
SP11 Gain2

P-Gain2        nnnn
I-Gain2        nnnn
```

nnnn - Enter the numerical value for the data.

Access Method	Identification	Permissible Values
CTA10-1 or BTC06-1	SP11	0 - 9.99 (P-Gain 2) 0 - 9.99 (I-Gain 2)
VisualTRANS	P-0-1210 P-0-1211	Same as above
Serial Protocol	DP 4.33978 DP 4.33979	Same as above
		Default: depends on motor/drive combo

P-Gain 2: This parameter defines the proportional gain of the speed regulator above the GAIN RPM (Parameter Sx12).

I-Gain 2: This parameter defines the integral gain of the speed regulator above the GAIN RPM (Parameter Sx12).

Enter the values to be used for this parameter. Press ENTER when the data is confirmed and the TRANS 01-D will store the data for this parameter and step to the next parameter.

Tip: If you make a mistake entering a value for an option within this parameter, use the left and right arrow keys on the CTA10-1 and enter the correct value. Using the ESC key will back you up to the previous parameter.

SP12 Gain RPM

```
SP12 Gain RPM

      nnnnn
```

nnnnn - Enter the numerical value for the data.

Access Method	Identification	Permissible Values
CTA10-1 or BTC06-1	SP12	0 - 30,000 rpm
VisualTRANS	P-0-1209	Same as above
Serial Protocol	DP 4.33977	Same as above
		Default: 1500

This parameter is the changeover speed from P/I-GAIN 1 to P/I-GAIN 2.

Enter the value to be used for this parameter. Press ENTER when the data is confirmed and the TRANS 01-D will store the data for this parameter and step to the next parameter.

Tip: If you make a mistake entering a value for an option within this parameter, use the left and right arrow keys on the CTA10-1 and enter the correct value. Using the ESC key will back you up to the previous parameter.

SP13 POS-Gain

```
SP13 POS - Gain

      nn.n
```

nnn - Enter the numerical value for the data.

Access Method	Identification	Permissible Values
CTA10-1 or BTC06-1	SP13	0 - 29
VisualTRANS	P-0-1217	Same as above
Serial Protocol	DP 4.33985	Same as above
		Default: 16.6

When a spindle positioning command (P) is programmed in the user program, this parameter sets the position loop gain that will be used for that positioning when this parameter set is active. A POS-Gain value of 16.6 corresponds to a position loop gain of 1. The drive converts this position loop gain into the proper gear ratio for the motor.

Enter the value to be used for this parameter. Press ENTER when the data is confirmed and the TRANS 01-D will store the data for this parameter and step to the next parameter.

Tip: If you make a mistake entering a value for an option within this parameter, use the left and right arrow keys on the CTA10-1 and enter the correct value. Using the ESC key will back you up to the previous parameter.

SP14 PQ-Functions

```
SP14 PQ - FUNCT
     Bit 0
Special
Positioning     n
```

```
SP14 PQ - FUNCT
     Bit 1
Spindle/Motor
Direction       n
```

```
SP14 PQ - FUNCT
     Bit 2
I-Gain Active
                n
```

```
SP14 PQ - FUNCT
     Bit 6
Position to Home
Switch          n
```

```
SP14 PQ - FUNCT
     Bit 8
Power Failure
Handling        n
```

n - Enter a 1 to enable the function, or a 0 to disable the specified function.

Access Method	Identification	Permissible Values
CTA10-1 or BTC06-1	SP14	xxxxxxx**n**x**n**xxx**nnn** bit 0 (0 - disable special positioning 1 - enable special positioning) bit 1 (0 - spindle/motor same direction 1 - spindle/motor not same dir.) Bit 2 (0 - I-Gain always active 1 - I-Gain not always active) Bit 6 (0 - Positioning w/ spindle encoder 1 - Positioning w/ home switch) Bit 8 (0 - drive-controlled braking 1 - TRANS-controlled braking)
VisualTRANS	P-0-1216	Same as above
Serial Protocol	DP 4.33984	Same as above
		Default: 0000000000000000

Special Positioning (Bit 0):

Position cam standard bit #0, PQFUNCT = 0

Bit #6 of P-x-1216 (PQFUNCT) = 1 and bit #0 of P-x-1216 (PQFUNCT) = 0 must be set.

The cam switch must be connected at input EXTPOS (X2, pin 37). The switch output is on the width of the cam = **24 volt**.

Once the command spindle position is activated, then the **rising** edge of the cam switch signal is searched for with speed P-x-1215 (cam search speed). Meanwhile, “HOMING” appears in display and diagnostics.

Positioning uses the speed S-0-0222 (spindle positioning speed) on the **rising** edge of the cam switch signal with position offset S-0-0153

(spindle angle position) + S-0-0151 (homing dimension offset 2). Meanwhile, “POSORDER” appears in the display and diagnostics.

If the spindle position is within the position window (S-0-0057), then status message “IN POS” appears in display and diagnostics. “Message in-position” (S-0-336) is set.

The rotational direction used to find the cam edges can be fixed with function bits. Positioning, however, always takes the shortest route!

Bit #0 and #1 from S-0-0154	= 00	cam search direction is clockwise
(position spindle parameter)	= 01	cam search direction is counterclockwise
	=10	the rotational direction of the current actual velocity value is assumed for the cam search
Bit #1 of P-x-1216	= 0	rotational direction of motor and spindle is the same
(position spindle parameter)	= 1	rotational direction of motor and spindle is not the same

Position cam special bit #0, PQFUNCT = 1

This cam positioning means a more rapid positioning with the same positioning accuracy in contrast to the cam positioning described in 8.2.1. More rapid positioning because the cam search has the higher S-x-0222, same precision because the cam edge search has the lower P-x-1215.

Bit #6 of P-x-1216 (PQFUNCT) and bit #0 of P-x-1216 (PQFUNCT) = 1 must be set.

The cam switch is connected at input EXTPOS (X2, pin 37). The switch output is on the width of the cam = **0 volt.**

Once the spindle position command is activated, the **falling** edge of the cam switch signal is searched for with *position spindle speed (S-x-0222)*. Meanwhile, “HOMING” appears in display and diagnostics.

The speed on the cam is reduced to *cam search speed (P-x-1215)*. With this speed, the **rising** edge of the cam switch signal is searched for. “HOMING” is still in display and diagnostics.

<u>If the cam search direction was positive:</u>

Positioning uses *position spindle speed (S-0-0222)* on the **falling** edge of the cam switch signal with offset *spindle angle position (S-0-0153)*. Meanwhile, “POSORDER” appears in display and diagnostics.

<u>If the cam search direction was negative:</u>

Positioning uses *position spindle speed (S-0-0222)* on the **falling** edge of the cam switch signal with offset *spindle angle position (S-0-0153) + homing offset 2 (S-0-0151)*. Meanwhile, “POSORDER” appears in display and diagnostics.

The physical width of the cam at the load must be entered in S-0-0151 so that the same position can be achieved regardless of the direction of search.

If the spindle position is within the position window (S-0-0057) then message “IN POS” appears in display and diagnostics. “Message in-position” (S-0-336) is set.

The rotational direction for finding the cam edge can be fixed with function bits. Positioning always, however, takes the shortest path!

Bit #0 and #1 of S-0-0154 (position spindle parameter)	= 00	cam search direction is clockwise
	= 01	cam search direction is counterclockwise
	=10	the rotational direction of the current actual velocity is used in the cam search
Bit #1 of P-x-1216 (Position spindle parameter)	= 0	cam search direction is clockwise
	= 1	cam search direction is counterclockwise

Spindle / Motor Direction (Bit 1): If rotational direction of motor and spindle are the same, set this bit to 0. If rotational direction of motor and spindle are not the same, set this bit to 1.

I-Gain Active (Bit 2): If the integral-action component of the speed controller is always active, set this bit to 0. Dead-beat stop: if the velocity command value (S-0-36) does not achieve the value programmed in zero velocity window (S-0-124), then the integral-action component of the speed controller is switched off (also see bit #4, P-0-1105)

Position to Home Switch (Bit 6): If you want Spindle positioning without a spindle encoder, but with a Home limit switch instead, set this bit to 1. If you are positioning the spindle with a second encoder interface and a spindle encoder, set this bit to a 0.

Power Failure Handling (Bit 8): If set to a 1, with a power failure, the TRANS 01-D controls the stoppage of the spindle motor using the appropriate command values. For this option, the RAC drive requires the use of option Z (internal bleeder resistor installed). If set to a 0, the drive will control the braking.

Enter the values to be used for this parameter. Press ENTER when the data is confirmed and the TRANS 01-D will store the data for this parameter and step to the next parameter.

Tip: If you make a mistake entering a value for an option within this parameter, use the left and right arrow keys on the CTA10-1 and enter the correct value. Using the ESC key will back you up to the previous parameter.

SA1 Maximum Speeds

```
SA1  Max  Speed
Program
Motor       nnnn.n
            nnnnnn
```

n - Enter the numerical values for the data.

Access Method	Identification	Permissible Values
CTA10-1 or BTC06-1	SA1	1 - 10,000 rpm
VisualTRANS	A-0-0320	Same as above
Serial Protocol	AP 4.320	Same as above
		Default: 1000

Program Speed: This value is read from the TRANS 01-D and cannot be changed here.

Motor Speed: This sets the maximum speed the drive will allow the motor to turn. The drive will not allow the motor to run at speeds greater than the programmed value. If a speed greater than this is programmed, an error will be issued by the TRANS 01-D.

Enter the value to be used for this parameter. Press ENTER when the data is confirmed and the TRANS 01-D will store the data for this parameter and step to the next parameter.

Tip: If you make a mistake entering a value for an option within this parameter, use the left and right arrow keys on the CTA10-1 and enter the correct value. Using the ESC key will back you up to the previous parameter.

SA2 Zero Velocity Window

```
SA2 Zero
Velocity Window
    nn
```

nn - Enter the numerical value for the Zero Velocity Window

Access Method	Identification	Permissible Values
CTA10-1 or BTC06-1	SA2	1 - 99 rpm
VisualTRANS	S-0-0124	Same as above
Serial Protocol	DP 4.124	Same as above
		Default: 25

This window sets the minimum velocity in which the motor operates. If the motor operates below this value, it is considered to be at zero velocity. If the motor velocity is below this value, the “Spindle at 0 Speed” output will turn on (high).

Enter the value to be used for this parameter. Press ENTER when the data is confirmed and the TRANS 01-D will store the data for this parameter and step to the next parameter.

Tip: If you make a mistake entering a value for an option within this parameter, use the left and right arrow keys on the CTA10-1 and enter the correct value. Using the ESC key will back you up to the previous parameter.

SA3 Velocity Window

```
SA3 Velocity
Velocity Window
    nn
```

n - Enter the numerical value for the data.

Access Method	Identification	Permissible Values
CTA10-1 or BTC06-1	SA3	1 - 99 rpm
VisualTRANS	S-0-0157	Same as above
Serial Protocol	DP 4.157	Same as above
		Default: 50

The actual velocity may deviate from the commanded velocity by this amount for the message $N_{act}=N_{cmd}$ to be displayed and for the corresponding output from the TRANS 01-D to go high. The message and output only come when the drive is in velocity mode and the drive is enabled.

Enter the value to be used for this parameter. Press ENTER when the data is confirmed and the TRANS 01-D will store the data for this parameter and step to the next parameter.

Tip: If you make a mistake entering a value for an option within this parameter, use the left and right arrow keys on the CTA10-1 and enter the correct value. Using the ESC key will back you up to the previous parameter.

SA4 Bipolar Torque Limit

```
SA4 Bipolar
Torque Limit %
      nnnnn
```

nnnnn - Enter the numerical value for Bipolar Torque Limit.

Access Method	Identification	Permissible Values
CTA10-1 or BTC06-1	SA4	1 - 100 %
VisualTRANS	S-0-0092	Same as above
Serial Protocol	DP 4.92	Same as above
		Default: 100%

This value corresponds to the torque command and actual values. It is a percentage of the continuous torque available in the system. The torque is always limited to this value. 100% must be programmed if no limit is desired!

The message “90% load” always refers to this torque limit value. This means that it always responds just before a torque limit.

Enter the value to be used for this parameter. Press ENTER when the data is confirmed and the TRANS 01-D will store the data for this parameter and step to the next parameter.

Tip: If you make a mistake entering a value for an option within this parameter, use the left and right arrow keys on the CTA10-1 and enter the correct value. Using the ESC key will back you up to the previous parameter.

SA5 Motor Overtemperature Warning

```
SA5 Motor
Overtemp Warning
      nnn
```

nnn - Enter the numerical value for Motor Overtemperature Warning.

Access Method	Identification	Permissible Values
CTA10-1 or BTC06-1	SA5	45 - 155ºC
VisualTRANS	S-0-0201	Same as above
Serial Protocol	DP 4.201	Same as above
		Default: 145ºC

This parameter gives the user the ability to set the motor temperature that, when reached, will tell the drive when to issue the message "Motor Overtemp Warning". The temperature warning can be set anywhere in the range of 45° to 155° Celsius. It makes sense to set it 10 degrees below that value programmed in S-0-0204 (motor shutdown temperature).

Enter the value to be used for this parameter. Press ENTER when the data is confirmed and the TRANS 01-D will store the data for this parameter and step to the next parameter.

Tip: If you make a mistake entering a value for an option within this parameter, use the left and right arrow keys on the CTA10-1 and enter the correct value. Using the ESC key will back you up to the previous parameter.

SA6 Motor Overtemperature Shutdown

```
SA6 Motor
Overtemp Shutdn
      nnn
```

nnn - Enter the numerical value for Motor Overtemperature Shutdown.

Access Method	Identification	Permissible Values
CTA10-1 or BTC06-1	SA6	45 - 155ºC
VisualTRANS	S-0-0204	Same as above
Serial Protocol	DP 4.204	Same as above
		Default: 145ºC

This parameter gives the user the ability to set the motor temperature that, when reached, will cause the drive to shut down and issue the error message “Motor Overtemp Shutdown”. The temperature can be set anywhere in the range of 45° to 155° Celsius. It makes sense to set it 10 degrees above the value programmed in S-0-0201 (motor overtemperature warning).

Enter the value to be used for this parameter. Press ENTER when the data is confirmed and the TRANS 01-D will store the data for this parameter and step to the next parameter.

Tip: If you make a mistake entering a value for an option within this parameter, use the left and right arrow keys on the CTA10-1 and enter the correct value. Using the ESC key will back you up to the previous parameter.

SA7 Directions

```
SA7 Directions
Velocity
                  n
```

```
SA7 Directions
Positioning
                  n
```

n - Enter 0 or 1 to set the desired direction.

Access Method	Identification	Permissible Values
CTA10-1 or BTC06-1	SA7: Velocity	bit 0 = 0 i.e., xxxxxxxxxxxxxxx0 (motor turns CW w/positive S cmd) bit 0 = 1 i.e., xxxxxxxxxxxxxxx1 (motor turns CCW w/positive S cmd)
	SA7: Positioning	bit 0 = 0 i.e., xxxxxxxxxxxxxxx0 (motor turns CW w/positive P cmd) bit 0 = 1 i.e., xxxxxxxxxxxxxxx1 (motor turns CCW w/positive P cmd)
VisualTRANS	A-0-0309 which is copied automatically to S-0-0043	0 (motor turns CW w/positive S cmd) or 1 (motor turns CCW w/positive S cmd) bit 0 = 0 i.e., xxxxxxxxxxxxxxx0 (motor turns CW w/positive S cmd) bit 0 = 1 i.e., xxxxxxxxxxxxxxx1 (motor turns CCW w/positive S cmd)
	A-0-0325 which is automatically copied to S-0-0055	0 (motor turns CW w/positive P cmd) or 1 (motor turns CCW w/positive P cmd) bit 0 = 0 i.e., xxxxxxxxxxxxxxx0 (motor turns CW w/positive P cmd) bit 0 = 1 i.e., xxxxxxxxxxxxxxx1 (motor turns CCW w/positive P cmd)
Serial Protocol	AP 4.309 copied to DP 4.43 AP 4.325 copied to DP 4.55	Same as above
		Default: CW

Velocity: This parameter sets the direction that the motor will turn when it receives the speed (S) command from a program block. If this bit is set to 0, with a positive speed command, the motor will turn clockwise (CW). If this bit is set to 1, with a positive speed command, the motor will turn counter-clockwise (CCW).

Note that the CTA / BTC writes the value to the TRANS 01-D specific axis parameter A-0-0309 which the TRANS 01-D then copies to drive parameter S-0-0043 (and also to axis parameters A-0-0020 and A-0-0021). When writing this parameter from VisualTRANS overview or Serial Protocol commands, it should be written to the axis parameter 309 rather than directly to the drive parameter.

Positioning: This parameter sets the direction that the motor will turn when it receives a positioning (P) command from a program block. If this bit is set to 0, with a positive position command, the motor will turn clockwise (CW). If this bit is set to 1, with a positive position command, the motor will turn counter-clockwise (CCW).

Note that the CTA / BTC writes the value to the TRANS 01-D specific axis parameter A-0-0325 which the TRANS 01-D then copies to drive parameter S-0-0044. When writing this parameter from VisualTRANS overview or Serial Protocol commands, it should be written to the axis parameter 325 rather than directly to the drive parameter.

Enter the values to be used for this parameter. Press ENTER when the data is confirmed and the TRANS 01-D will store the data for this parameter and step to the next parameter.

Tip: If you make a mistake entering a value for an option within this parameter, use the left and right arrow keys on the CTA10-1 and enter the correct value. Using the ESC key will back you up to the previous parameter.

SA8 Resolution of External Feedback

```
S A 8   R e s o l u t i o n
o f   E x t   F e e d b a c k
          n n n n
```

nnnn - Enter the numerical value for the Resolution of an External Feedback.

Access Method	Identification	Permissible Values
CTA10-1 or BTC06-1	SA8	3 - 8192 lines per revolutions (LPR)
VisualTRANS	S-0-0117	Same as above
Serial Protocol	DP 4.117	Same as above
		Default: 1024 LPR

If the DIAX01 drive system is using an external feedback device for spindle positioning, the resolution value for the attached external feedback device must be entered here.

Note: External Feedback resolution specifications are usually contained in the manufacturer’s documentation. It may also be contained in the machine documentation. Please consult this documentation or call the Indramat Service Hotline at 800-860-1055.)

Enter the value to be used for this parameter. Press ENTER when the data is confirmed and the TRANS 01-D will store the data for this parameter and step to the next parameter.

Tip: If you make a mistake entering a value for an option within this parameter, use the left and right arrow keys on the CTA10-1 and enter the correct value. Using the ESC key will back you up to the previous parameter.

SA9 Reference Offsets

```
SA9 Ref.Offset
Motor Fdbk   nnnn
Ext. Fdbk    nnnn
2nd Motor    nnnn
```

nnnn - Enter the numerical value for Reference Offset. Offsets values are in degrees (°).

Access Method	Identification	Permissible Values
CTA10-1 or BTC06-1	SA9	0 - 359.9º (Motor Feedback) 0 - 359.9º (External Feedback) 0 - 359.9º (2nd Motor)
VisualTRANS	S-0-0150 S-0-0151 P-0-1020	0 - 359.9º (Motor Feedback) 0 - 359.9º (External Feedback) 0 - 359.9º (2nd Motor)
Serial Protocol	DP 4.150 DP 4.151 DP 4.33788	0 - 359.9º (Motor Feedback) 0 - 359.9º (External Feedback) 0 - 359.9º (2nd Motor)
		Default: 0

Motor Feedback: Shifts the motor zero point by the value entered here.

External Feedback: Shifts the zero point of the second encoder. This value also affects the Home switch zero point, if Home switch positioning has been enabled in Sx14, bit 6.

2nd motor: Shifts the motor zero point of the second motor with a two-motor changeover.

Enter the values to be used for this parameter. Press ENTER when the data is confirmed and the TRANS 01-D will store the data for this parameter and step to the next parameter.

Tip: If you make a mistake entering a value for an option within this parameter, use the left and right arrow keys on the CTA10-1 and enter the correct value. Using the ESC key will back you up to the previous parameter.

SA10 Motor Oscillation Settings

```
SA10 Set Osc.
Speed      nnnnnnn
Of Speed   nnnnnnn
Cyc Time     nnnnn
```

nnnnn(nn) - Enter the numerical value for the motor Oscillation Settings.

Access Method	Identification	Permissible Values
CTA10-1 or BTC06-1	SA10	1 - 200 rpm(Oscillation Speed) 1 - 200 rpm(Oscillation Offset Speed) 32 - 655504.0 ms (Oscillation Cycle Time)
VisualTRANS	S-0-0213 S-0-0214 S-0-0215	1 - 200 rpm(Oscillation Speed) 1 - 200 rpm(Oscillation Offset Speed) 32 - 655504.0 ms (Oscillation Cycle Time)
Serial Protocol	DP 4.213 DP 4.214 DP 4.215	1 - 200 rpm(Oscillation Speed) 1 - 200 rpm(Oscillation Offset Speed) 32 - 655504.0 ms (Oscillation Cycle Time)
		Default: 1 rpm (oscillation & offset speed), 32ms (oscillation cycle time)

The Engaging dither amplitude defines the maximum speed of the drive in both directions during the Drive controlled gear engaging procedure command. Data reference is the motor shaft.

Oscillation speed: Sets the maximum speed to be used when the Drive Controlled Oscillation command is set to accommodate a gear change.

Oscillation Offset speed: During the Drive Controlled Oscillation procedure command, the drive adds this speed value to the programmed oscillation speed.

Oscillating Cycle time: During the Drive Controlled Oscillation procedure command, the drive oscillates at its programmed speed for the time entered in this parameter.

Enter the values to be used for this parameter. Press ENTER when the data is confirmed and the TRANS 01-D will store the data for this parameter and step to the next parameter.

Tip: If you make a mistake entering a value for an option within this parameter, use the left and right arrow keys on the CTA10-1 and enter the correct value. Using the ESC key will back you up to the previous parameter.

SA11 Function 1

```
SA11 FUNCT1
      Bit 0
Torque/Power
Limiting        n
```

```
SA11 FUNCT1
      Bit 3
Position to Ext.
Feedback        n
```

```
SA11 FUNCT1
      Bit 5
N-Output RPM or
Bus Voltage     n
```

```
SA11 FUNCT1
      Bit 6
N-Output Variabl
                n
```

```
SA11 FUNCT1
      Bit 7
N-Output RPM or
Motor Temp      n
```

n - Enter a 1 to enable the function, or a 0 to disable the specified function.

Access Method	Identification	Permissible Values
CTA10-1 or BTC06-1	SA11	xxxxxxxx**nnn**x**n**xx**n** bit 0 (0 - limit torque and power 1 - limit torque only) bit 3 (0 - use external encoder 1 - ignore ext. encoder) Bit 5 (0 - N-output is speed 1 - N-output is bus voltage) Bit 6 (0 - N-output torque is smoothed 1 - N-output torque is actual) Bit 7 (0 - N-output is speed 1 - N-output is motor temperature)
Serial Protocol	DP 4.33873	Same as above
VisualTRANS	P-0-1105	Same as above
		Default: 0000000000000000

Torque/Power Limiting (Bit 0): When set to a 0, the bipolar torque limit value limits torque and output on a percentage basis. When set to a 1, only the torque is limited. This means that within the field weakening range where the maximum torque has, for example, fallen to 50%, a reduction only then sets in if the bipolar torque limit value is less than 50%. In this case, a limitation would not take place until above twice the drop-off speed.

Position to External Feedback (Bit 3): When set to a 0, the Second encoder input (X5) is used for spindle positioning (requires an external feedback device). When set to a 1, the second encoder input (X5) is ignored. (Exception: winding switch-over, see SA12 (FUNCT2)).

N-Output RPM or Bus voltage (Bit 5): When set to a 0, the N-output (analog output) on the drive represents the speed of the spindle motor. When set to a 1, the N-output (analog output) on the drive represents the level of the internal DC bus.

N-Output Variable or Torque (Bit 6): When set to a 0, the torque value on the N-output (analog output) on the drive represents a smoothed representation of the drives torque. When set to a 1, the torque value on the N-output (analog output) on the drive represents the actual, un-smoothed value of the drives torque.

N-Output RPM or Motor Temperature (Bit 7): When set to a 0, the N-output (analog output) on the drive represents the speed of the spindle motor. When set to a 1, the N-output (analog output) on the drive represents the temperature of the spindle motor..

Enter the values to be used for this parameter. Press ENTER when the data is confirmed and the TRANS 01-D will store the data for this parameter and step to the next parameter.

Tip: If you make a mistake entering a value for an option within this parameter, use the left and right arrow keys on the CTA10-1 and enter the correct value. Using the ESC key will back you up to the previous parameter.

SA12 Function 2

```
SA12 FUNCT2
      Bit 2
Motor Winding
Switching          n
```

```
SA12 FUNCT2
      Bit 5
Velocity Ramp
for E-Stop         n
```

```
SA12 FUNCT2
      Bit 6
RAC Chopper
Active             n
```

```
SA12 FUNCT2
      Bit 8
Bleeder Monitor
                   n
```

```
SA12 FUNCT2
      Bit 10
Monitor External
Feedback           n
```

n - Enter a 1 to enable the function, or a 0 to disable the specified function.

Access Method	Identification	Permissible Values
CTA10-1 or BTC06-1	SA12	xxxxx**n**x**n**x**nn**xx**n**xx bit 2 (0 - disable motor/winding switching 1 - enable motor/winding switching) bit 5 (0 - TRANS-controlled braking 1 - drive-controlled braking) Bit 6 (0 - do not raise bus voltage 1 - raise bus voltage) Bit 8 (0 - disable bleeder monitor 1 - enable bleeder monitor) Bit 10 (0 - internal monitor of ext. enc. Active 1 - internal monitor of ext. enc. inactive)
VisualTRANS	P-0-1106	Same as above
Serial Protocol	DP 4.33874	Same as above
		Default: 0000000000000000

Motor Winding Switching (Bit 2): When set to a 0, normal function of the second encoder input X5 is available, no motor or winding switch-over. When set to a 1, two options are possible 1) Two motor switch-over possible if second encoder input (X5) is implemented and SA11 FUNCT 1, bit #3 = 0, and 2) Winding switch-over (Wye/Delta), if SA11 FUNCT1, bit #3 = 1

Velocity Ramp for E-Stop (Bit 5): When set to a 0, the drive’s decel ramp does not function with E-stop and bleeder braking, the TRANS 01-D will control the stop. When set to a 1, the speed ramp in the drive is active with E-stop and bleeder braking and the drive will decel the motor in an E-Stop condition.

RAC Chopper Active (Bit 6): When set to a 0, the bus voltage will not be raised if the mains are low. When set to a 1, Raising the DC Bus voltage will be activated with mains under-voltage (RAC3). This prevents a drop in peak power with mains under-voltage.

Bleeder Monitor (Bit 8): If set to a 0, the bleeder monitoring in the drive is not active. If set to a 1, Bleeder monitoring is active in RAC drives with Z1 option.

Monitor External Feedback (Bit 10): When set to 0, with position control using an external encoder, the internal monitoring of the external encoder is active. When set to 1, monitoring of the external encoder not is not active

Enter the values to be used for this parameter. Press ENTER when the data is confirmed and the TRANS 01-D will store the data for this parameter and step to the next parameter.

Tip: If you make a mistake entering a value for an option within this parameter, use the left and right arrow keys on the CTA10-1 and enter the correct value. Using the ESC key will back you up to the previous parameter.

SM1 Feedback

```
SM1  FEEDBACK

Feedback type   n
T Filter        n
```

n - Enter the numerical value for Feedback type and T Filter.

Access Method	Identification	Permissible Values
CTA10-1 or BTC06-1	SM1	1 -6 (feedback type) 0 - 3 (T-filter)
VisualTRANS	P-0-1002 P-0-1003	1 -6 (feedback type) 0 - 3 (T-filter)
Serial Protocol	DP 4.33770 DP 4.33771	1 -6 (feedback type) 0 - 3 (T-filter)
		Default: 1 (feedback type), 3 (T-filter)

Feedback type: Type 1 indicates that a standard 1024 LPR (lines per revolution) encoder is used. Type 3 indicates that Indramat's High Resolution feedback is used.

Motor name plate example:

2AD 132 D-B35-0B1-BS0**1**-ANS1

1 - WI 519 1024 LPR Feedback
3 - HG 101 High Resolution Feedback

T Filter: This parameter is the filtering factor for the signal from the motor feedback. Used for feedback filtering. For type 1 feedback , T-filtering should be set to "3". For type 3 feedback , T-filtering should be set to "1".

Note: If a high resolution feedback is used, only the values greater than or equal to 0.1 and 2 are permitted.

Enter the values to be used for this parameter. Press ENTER when the data is confirmed and the TRANS 01-D will store the data for this parameter and step to the next parameter.

Tip: If you make a mistake entering a value for an option within this parameter, use the left and right arrow keys on the CTA10-1 and enter the correct value. Using the ESC key will back you up to the previous parameter.

SM2 Poles / Slip Limit

```
SM2  POLES/SLIP
    LIMIT
Poles              n
Slip Limit       nnn
```

n - Enter the numerical value for Poles / Slip Limit.

Access Method	Identification	Permissible Values
CTA10-1 or BTC06-1	SM2	2 - 8 (Poles) 1 - 7.9 (Slip Limit)
VisualTRANS	P-0-1001 P-0-1004	2 - 8 (Poles) 1 - 7.9 (Slip Limit)
Serial Protocol	DP 4.33769 DP 4.33772	2 - 8 (Poles) 1 - 7.9 (Slip Limit)
		Default: depends on motor/drive combo

Poles: This is a physical parameter of the induction motor which defines the number of poles. This parameter must be programmed as specified in the DIAX01/2AD Parameter List for the given motor/drive combination. Please refer to the appropriate DIAX01 drive controller manual for the correct parameter lists.

Slip Limit: This parameter defines the slip limit as a multiple of the signature slip (rated slip, parameter SM4).

Enter the values to be used for this parameter. Press ENTER when the data is confirmed and the TRANS 01-D will store the data for this parameter and step to the next parameter.

Tip: If you make a mistake entering a value for an option within this parameter, use the left and right arrow keys on the CTA10-1 and enter the correct value. Using the ESC key will back you up to the previous parameter.

SM3 Flux / Current

```
SM3  FLUX/
CURRENT
Flux           nnn
Current        nnn
```

n - Enter the numerical value for Flux and Current.

Access Method	Identification	Permissible Values
CTA10-1 or BTC06-1	SM3	1 - 400 (Flux) 1 - 400 (Current)
VisualTRANS	P-0-1005 P-0-1006	1 - 400 (Flux) 1 - 400 (Current)
Serial Protocol	DP 4.33773 DP 4.33774	1 - 400 (Flux) 1 - 400 (Current)
		Default: depends on motor/drive combo

Flux: This parameter defines the motor magnetizing flux current required for developing the rated torque. Do not exceed the maximum value specified in the DIAX01/2AD Motor Parameter List for the motor/drive combination.

Current: This parameter determines the maximum motor current (peak value in Amps).

Enter the values to be used for this parameter. Press ENTER when the data is confirmed and the TRANS 01-D will store the data for this parameter and step to the next parameter.

Tip: If you make a mistake entering a value for an option within this parameter, use the left and right arrow keys on the CTA10-1 and enter the correct value. Using the ESC key will back you up to the previous parameter.

SM4 Sign

```
SM4  SIGN
Slip          nnn
Rpm         nnnnn
Volt         nnnn
```

nnn - Enter the numerical values for Slip, Rpm and Voltage.

Access Method	Identification	Permissible Values
CTA10-1 or BTC06-1	SM4	0 - 414 (Sign Slip) 500 - 30,000 rpm (Sign RPM) 0 - 999V (Sign Voltage)
VisualTRANS	P-0-1007 P-0-1008 P-0-1010	0 - 414 (Sign Slip) 500 - 30,000 rpm (Sign RPM) 0 - 999V (Sign Voltage)
Serial Protocol	DP 4.33775 DP 4.33776 DP 4.33778	0 - 414 (Sign Slip) 500 - 30,000 rpm (Sign RPM) 0 - 999V (Sign Voltage)
		Default: depends on motor/drive combo

Sign Slip: This parameter defines the characteristic slip of the motor.

Sign RPM: This parameter defines the starting point of slip increase. The point at which slip limit will be activated.

Sign Voltage: This parameter indicates the motor's characteristic idle (no load) voltage at Sign RPM.

Enter the values to be used for this parameter. Press ENTER when the data is confirmed and the TRANS 01-D will store the data for this parameter and step to the next parameter.

Tip: If you make a mistake entering a value for an option within this parameter, use the left and right arrow keys on the CTA10-1 and enter the correct value. Using the ESC key will back you up to the previous parameter.

SM5 Motor Functions

```
SM5  MOTFUNCT

MOTFUNCT        nn
```

nn - Enter the numerical value for Motor Functions.

Access Method	Identification	Permissible Values
CTA10-1 or BTC06-1	SM5	*depends on motor/drive combo*
VisualTRANS	P-0-1015	Same as above
Serial Protocol	DP 4.33783	Same as above
		Default: 35

This parameter controls various functions of the motor. The sum of the selected function must be programmed in to this parameter. Refer to the following Function Code Table

FUNCTION	Code	FUNCTION	Code
VOLTFACT (M 13) is operative.	1	VOLTFACT (M 13) is not active but the standard voltage boost is operative.	0
SLIPFACT (M 14) is operative.	2	SLIPFACT (M 14) is not active. Standard boost of slippage is operative.	0
Voltage command amplitude is limited to 7V.	4	No changes.	0
Voltage command voltage for the motor output is limited to 7 V during no load operation.	8	N/A	0
Same as MOTFUNCT 8, but voltage increases to the maximum value during deceleration.	12	N/A	0
DC current braking active without optional bleeder resistor. During main power loss condition, RAC will utilize DC current to decelerate the motor.	16	DC current braking not active.	0
PWM Frequency changes 565 micro seconds for RAC 2.2-250.	32	PWM frequency stays at 600 micro seconds for RAC 2.2-250.	0
Bigger SLIP boost for water cooled motor.	64	Normal SLIP boost.	0

Enter the values to be used for this parameter. Press ENTER when the data is confirmed and the TRANS 01-D will store the data for this parameter and step to the next parameter.

Tip: If you make a mistake entering a value for an option within this parameter, use the left and right arrow keys on the CTA10-1 and enter the correct value. Using the ESC key will back you up to the previous parameter.

SM10 Feedback

```
SM10  FEEDBACK

Feedback type   n
T Filter        n
```

n - Enter the numerical value for Feedback type and T Filter.

Access Method	Identification	Permissible Values
CTA10-1 or BTC06-1	SM10	1 - 3 (feedback type) 1 - 3 (T-filter)
VisualTRANS	P-0-1022 P-0-1023	1 - 3 (feedback type) 1 - 3 (T-filter)
Serial Protocol	DP 4.33790 DP 4.33791	1 - 3 (feedback type) 1 - 3 (T-filter)
		Default: 1 (feedback type), 3 (T-filter)

Feedback type: Type 1 indicates that a standard 1024 LPR (lines per revolution) encoder is used. Type 3 indicates that Indramat's High Resolution feedback is used.

Motor name plate example:

2AD 132 D-B35-0B1-BS0**1**-ASN1

1 - WI 519 1024 LPR Feedback
3 - HG 101 High Resolution Feedback

T Filter: This parameter is the filtering factor for the signal from the motor feedback. Used for feedback filtering. For type 1 feedback , T-filtering should be set to "3". For type 3 feedback , T-filtering should be set to "1".

Note: If a high resolution feedback is used, only the values greater than or equal to 0.1 and 2 are permitted.

Enter the values to be used for this parameter. Press ENTER when the data is confirmed and the TRANS 01-D will store the data for this parameter and step to the next parameter.

Tip: If you make a mistake entering a value for an option within this parameter, use the left and right arrow keys on the CTA10-1 and enter the correct value. Using the ESC key will back you up to the previous parameter.

SM11 Poles / Slip Limit

```
SM11  POLES/SLIP
   LIMIT
Poles           n
Slip Limit    nnn
```

n - Enter the numerical value for Poles / Slip Limit.

Access Method	Identification	Permissible Values
CTA10-1 or BTC06-1	SM2	2 - 8 (Poles) 1 - 7.9 (Slip Limit)
VisualTRANS	P-0-1021 P-0-1024	2 - 8 (Poles) 1 - 7.9 (Slip Limit)
Serial Protocol	DP 4.33789 DP 4.33792	2 - 8 (Poles) 1 - 7.9 (Slip Limit)
		Default: depends on motor/drive combo

Poles: This is a physical parameter of the induction motor which defines the number of poles. This parameter must be programmed as specified in the DIAX01/2AD Parameter List for the given motor/drive combination. Please refer to the appropriate DIAX01 drive controller manual for the correct parameter lists.

Slip Limit: This parameter defines the slip limit as a multiple of the signature slip (rated slip, parameter SM4).

Enter the values to be used for this parameter. Press ENTER when the data is confirmed and the TRANS 01-D will store the data for this parameter and step to the next parameter.

Tip: If you make a mistake entering a value for an option within this parameter, use the left and right arrow keys on the CTA10-1 and enter the correct value. Using the ESC key will back you up to the previous parameter.

SM12 Flux / Current

```
SM12 FLUX/
CURRENT
Flux          nnn
Current       nnn
```

n - Enter the numerical value for Flux and Current.

Access Method	Identification	Permissible Values
CTA10-1 or BTC06-1	SM12	1 - 400 (Flux) 1 - 400 (Current)
VisualTRANS	P-0-1025 P-0-1026	1 - 400 (Flux) 1 - 400 (Current)
Serial Protocol	DP 4.33793 DP 4.33794	1 - 400 (Flux) 1 - 400 (Current)
		Default: depends on motor/drive combo

Flux: This parameter defines the motor magnetizing flux current required for developing the rated torque. Do not exceed the maximum value specified in the DIAX01/2AD Motor Parameter List for the motor/drive combination.

Current: This parameter determines the maximum motor current (peak value in Amps).

Enter the values to be used for this parameter. Press ENTER when the data is confirmed and the TRANS 01-D will store the data for this parameter and step to the next parameter.

Tip: If you make a mistake entering a value for an option within this parameter, use the left and right arrow keys on the CTA10-1 and enter the correct value. Using the ESC key will back you up to the previous parameter.

SM13 Sign

```
SM13  SIGN
Slip         nnn
Rpm        nnnnn
Volt        nnnn
```

nnn - Enter the numerical values for Slip, Rpm and Voltage.

Access Method	Identification	Permissible Values
CTA10-1 or BTC06-1	SM13	0 - 414 (Sign Slip) 500 - 30,000 rpm (Sign RPM) 0 - 999V (Sign Voltage)
VisualTRANS	P-0-1027 P-0-1028 P-0-1030	0 - 414 (Sign Slip) 500 - 30,000 rpm (Sign RPM) 0 - 999V (Sign Voltage)
Serial Protocol	DP 4.33795 DP 4.33796 DP 4.33798	0 - 414 (Sign Slip) 500 - 30,000 rpm (Sign RPM) 0 - 999V (Sign Voltage)
		Default: depends on motor/drive combo

Sign Slip: This parameter defines the characteristic slip of the motor.

Sign RPM: This parameter defines the starting point of slip increase. The point at which slip limit will be activated.

Sign Voltage: This parameter indicates the motor's characteristic idle (no load) voltage at Sign RPM.

Enter the values to be used for this parameter. Press ENTER when the data is confirmed and the TRANS 01-D will store the data for this parameter and step to the next parameter.

Tip: If you make a mistake entering a value for an option within this parameter, use the left and right arrow keys on the CTA10-1 and enter the correct value. Using the ESC key will back you up to the previous parameter.

SM14 Motor Functions

```
S M 1 4   M O T F U N C T

M O T F U N C T          n n
```

nn - Enter the numerical value for Motor Functions.

Access Method	Identification	Permissible Values
CTA10-1 or BTC06-1	SM14	*depends on motor/drive combo*
VisualTRANS	P-0-1035	Same as above
Serial Protocol	DP 4.33803	Same as above
		Default: 35

This parameter controls various functions of the motor. The sum of the selected function must be programmed in to this parameter. Refer to the following Function Code Table

FUNCTION	Code	FUNCTION	Code
VOLTFACT (M 13) is operative.	1	VOLTFACT (M 13) is not active but the standard voltage boost is operative.	0
SLIPFACT (M 14) is operative.	2	SLIPFACT (M 14) is not active. Standard boost of slippage is operative.	0
Voltage command amplitude is limited to 7V.	4	No changes.	0
Voltage command voltage for the motor output is limited to 7 V during no load operation.	8	N/A	0
Same as MOTFUNCT 8, but voltage increases to the maximum value during deceleration.	12	N/A	0
DC current braking active without optional bleeder resistor. During main power loss condition, RAC will utilize DC current to decelerate the motor.	16	DC current braking not active.	0
PWM Frequency changes 565 micro seconds for RAC 2.2-250.	32	PWM frequency stays at 600 micro seconds for RAC 2.2-250.	0
Bigger SLIP boost for water cooled motor.	64	Normal SLIP boost.	0

Enter the values to be used for this parameter. Press ENTER when the data is confirmed and the TRANS 01-D will store the data for this parameter and step to the next parameter.

Tip: If you make a mistake entering a value for an option within this parameter, use the left and right arrow keys on the CTA10-1 and enter the correct value. Using the ESC key will back you up to the previous parameter.

3.5 Spindle Parameters for DIAX02/03/04 Digital Drives

Only those servo and spindle axes that were activated and configured in P02 Axis Configuration, page 3-15, will be available for selection.

```
Select Axis
 1.X-Axis
 2.Y-Axis
 3.Z-Axis
```

```
Select Axis
 2.Y-Axis
 3.Z-Axis
→4.S-Axis
```

When S-Axis is selected from the Select Axis screen, the TRANS 01-D can determine what type of DIAX digital drive is connected. When a DIAX02 (DDS02.1, DDS03.1, etc.), DIAX03 (DDS02.2, DDS03.2, etc.) or DIAX04 (HDD, HDS, etc.) digital drive is connected to the TRANS 01-D as a spindle axis, the screens below will be displayed to allow the user the ability to create or modify parameter data.

When using DIAX02 drives

```
Diax2 Parameters
For S-Axis(0-13)
 AS#=    0
:Units
```

When using DIAX03/04 drives

```
Diax3/4 Parametr
For S-Axis(0-13)
 AS#=    0
:Units
```

Axis Parameter Number

Each parameter can be selected by entering it's number in this primary screen or by scrolling up or down using the arrow keys and pressing ENTER on the CTA10-1.

AS00 Units

```
AS00 Units
Enter UnIts Per
Table RevolutIon
   nnn.nnn
```

This parameter is only used with DIAX01/02 drives. Set the value to 360°

AS01 Positioning Feedback Type - Motor Encoder

```
AS01 Positioning
Feedback Type
→1.Motor Encoder
 2.Linear Scale
```

```
AS01 Primary
Positioning Enc.
→1.Motor Encoder
 2.Linear Scale
```

Press the number key or use the up and down arrows to move the arrow to the type of positioning device you want to use for this axis. When selecting 1, the digital servo drive will automatically configure itself for the motor encoder.

Note: After selecting 1 for Motor Encoder, a second entry similar to the first must be made if the motor encoder is to be used as the primary positioning device. If no other positioning device is connected to the TRANS 01-D system, select 1 at this screen. By doing is, all positional moves in the user program will be based upon the position of the motor encoder and the next parameter will be displayed.

If the motor encoder is different than the last time the drive was powered up, you will get a **UL error** on the digital drive H1 display. Pressing the S1 reset switch on the digital drive will load the parameters for the new feedback into the SPINDLE drive.

Access Method	Identification	Permissible Values
CTA10-1 or BTC06-1	AS01	1 (use motor encoder) 2 (use external linear scale) 3 (use external rotary encoder)
VisualTRANS		bit 11 = 0, i.e., xxxxx0xxxxxxxxxxx (use motor fdbk as primary device) bit 11 = 1, i.e., xxxxx1xxxxxxxxxxx (use external fdbk as primary device)
Serial Protocol		Same as above
		Default: use motor feedback

Every Indramat digital drive uses the motor encoder for axis control. It can also use it for axis positioning. If your application will be using the motor encoder for axis positioning, then select 1 for this parameter.

Refer to the subsections for AS01 Positioning Feedback Type - Linear Scale or AS01 Positioning Feedback Type - External Rotary Encoder if one of these types of feedback devices is to be used.

The option entered here is written to the TRANS 01-D Axis parameter A-0-0004. If the external encoder is to be used as the primary positioning device, the CTA10-1 will set A-0-0004 bit 10 to a 1 for a linear scale or an external rotary encoder. The data entered into this parameter determines what the TRANS 01-D will write to Drive Parameter S-0-0032. The user cannot change this option by writing to drive parameter S-0-0032 directly because the TRANS 01-D will overwrite parameter S-0-0032 based upon the data in A-0-0004 when it exits Parameter Mode.

AS01 Positioning Feedback Type - Linear Scale

```
AS01 Positioning
Feedback Type
 1.Motor Encoder
→2.Linear Scale
```

```
AS01 Primary
Positioning Enc.
 1.Motor Encoder
→2.Linear Scale
```

```
AS01 Linear
Scale Resolution
   (UM/Pulse)
      nnnnn
```

This screen appears when 2. Linear Scale is selected.

Press 2 to select Linear Scale as the positioning feedback or use the up and down arrows and press ENTER. If an external linear scale is used for primary axis positioning, select 2 at the Primary Positioning Encoder screen. The next screen that appears is the Linear Scale Resolution screen and requires that you enter the distance per pulse for the linear scale you are using.

Note: Linear Scale resolution specifications are usually contained in the manufacturer's documentation. It may also be contained in the machine documentation. Please consult this documentation or call the Indramat Service Hotline at 800-860-1055.

When a value is entered on the second screen, the TRANS 01-D will store the data and step to the next parameter.

nnnnn - Enter the distance per pulse of the linear scale being used for positioning.

Access Method	Identification	Permissible Values
CTA10-1 or BTC06-1	AS01	1 (use motor encoder) 2 (use external linear scale) 3 (use external rotary encoder)
VisualTRANS		bit 11 = 0, i.e., xxxxx0xxxxxxxxxx (use motor fdbk as primary device) bit 11 = 1, i.e., xxxxx1xxxxxxxxxx (use external fdbk as primary device) Set resolution for external linear scale: 0.0 - 21474.83647
Serial Protocol		Same as above
		Default: use motor feedback

Note: Additional interface cards may be necessary when external feedback devices are used. Please consult machine documentation or call the Indramat at 800-860-1055.

The option selected here is written to the TRANS 01-D Axis parameter A-0-0004. If the external encoder is to be used as the primary positioning device, the CTA10-1 will set Axis parameter A-0-0004 bit 10 to a 1 for a linear scale or an external rotary encoder. The data entered into this parameter determines what the TRANS 01-D will write to Drive Parameter S-0-0032. The user cannot change this option by writing to drive parameter S-0-0032 directly because the TRANS 01-D will overwrite parameter S-0-0032 based upon the data in A-0-0004 when it exits Parameter Mode.

The values entered in the last screen are entered into Drive Parameter S-0-0118. This parameter can also be set through VisualTRANS and the Serial Protocol.

AS01 Positioning Feedback Type - External Rotary Encoder

```
AS01 Positioning
Feedback Type
 2.Linear Scale
→3.External Enc.
```

```
AS01 Primary
Positioning Enc.
 2.Linear Scale
→3.External Enc.
```

```
AS01 Rotary
Resolution
     (LPR)
        nnnn
```

This screen appears when 3. External Encoder is selected.

Press 3 to select an External Rotary Encoder as the positioning feedback or use the up and down arrows and press ENTER. If the external rotary encoder is used for primary axis positioning, select 3 at the Primary Positioning Encoder screen. The next screen that appears is the Rotary Resolution screen and requires that you enter the lines per revolution (LPR) for the external rotary encoder you are using.

Note: External rotary encoder specifications are contained in the manufacturer's documentation. It may also be contained in the machine documentation. Please consult this documentation or call the Indramat Service Hotline at 800-860-1055.

When a value is entered on the second screen, the TRANS 01-D will store the data and step to the next parameter.

nnnn - Enter the line count per revolution of the external encoder being used.

Access Method	Identification	Permissible Values
CTA10-1 or BTC06-1	AS01	1 (use motor encoder) 2 (use external linear scale) 3 (use external rotary encoder)
VisualTRANS		bit 11 = 0, i.e., xxxxx0xxxxxxxxxx (use motor fdbk as primary device) bit 11 = 1, i.e., xxxxx1xxxxxxxxxx (use external fdbk as primary device) Set resolution for external rotary encoder: 0.0 - 21474.83647
Serial Protocol		Same as above
		Default: use motor feedback

Note: Additional interface cards may be necessary when external feedback devices are used. Please consult machine documentation or call the Indramat at 800-860-1055.

The option selected here is written to the TRANS 01-D Axis parameter A-0-0004. If the external encoder is to be used as the primary positioning device, the CTA10-1 will set Axis parameter A-0-0004 bit 10 to a 1 for a

linear scale or an external rotary encoder. The data entered into this parameter determines what the TRANS 01-D will write to Drive Parameter S-0-0032. The user cannot change this option by writing to drive parameter S-0-0032 directly because the TRANS 01-D will overwrite parameter S-0-0032 based upon the data in A-0-0004 when it exits Parameter Mode.

The values entered in the last screen are entered into Drive Parameter S-0-0117. This parameter can also be set through VisualTRANS and the Serial Protocol.

AS02 Homing Reference

```
AS02 Homing
   Reference
→1.Switch/Mpulse
 2.Switch
```

```
AS02 Homing
   Reference
 3.Marker Pulse
 4.To Pos.Stop
```

Press the number key or use the up and down arrows to move the arrow to the referencing method you want to use for this axis.

Access Method	Identification	Permissible Values
CTA10-1 or BTC06-1	AS02	1 (home to marker pulse and switch) 2 (home to switch) 3 (home to marker pulse) 4 (home to positive stop)
VisualTRANS		Same as above
Serial Protocol		Same as above
		Default: none

The user has the option of using the Marker pulse, the Home switch, both the Marker and the Switch or a Positive Stop as the machine Home reference point. When the TRANS 01-D is commanded to Home an axis (G74), the Homing sequence used is the sequence pre-defined in the digital drive. The Home position is determined by the drive and relayed to the TRANS 01-D via the SERCOS channel. For a full explanation of the Homing routine, please refer to the appropriate application manual for the connected digital drive.

Switch and Marker Pulse

When using the switch and marker pulse, the Home position will be the first marker pulse encountered after the Home switch is made

Marker Pulse

When using marker pulse, the axis will home to the first marker pulse it encounters after it receives the Home input (or Reverse in Manual mode).

Switch

When using switch, the TRANS 01-D will Home to the first switch input it sees. The position at which it saw the switch will be considered Home.

Note: Homing to a switch is not available when using an Absolute Encoder for positioning (while absolute feedback is enabled).

Home to a Positive Stop

When a G69 command is programmed in the Homing block, the TRANS 01-D will execute a feed to a positive stop to an incremental programmed distance. If the incremental distance is reached, the TRANS 01-D will issue a “Positive ‘Stop Missing” diagnostic. If the positive stop is encountered correctly, the TRANS 01-D will move away from the Positive stop the distance entered in Parameter Aa22 (Home to Stop Distance) and declare that position to be Home (machine zero). For

a full explanation of this feature, please see the Homing Section in the Programming chapter.

Note: Homing to a Positive Stop is only available on systems that use absolute feedback devices.

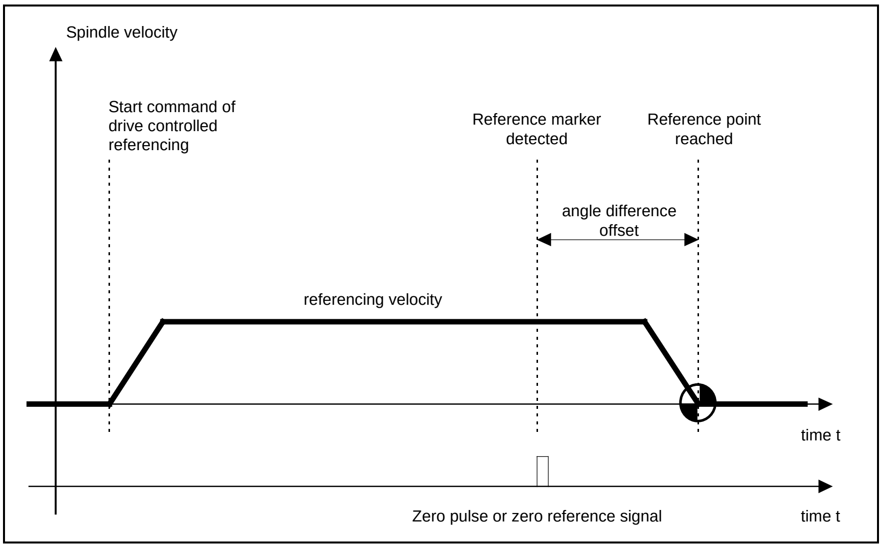
After selecting your option, the TRANS 01-D will store this setting and step ahead to the next parameter.

AS03 Positioning OFFSET

```
AS3  Positioning
     OFFSET
     nnn.n  degree
```

The position difference between the zero pulse of the measuring device and the reference point (zero point) of the spindle is added via this offset value.

The actual position value generated by the drive does not reference the zero position of the spindle until after the first command has been completed.



Velocity time diagram for drive controlled referencing

AS04 Gear Ratio

```
AS04 Gear Ratio
Revs In:Revs Out
   nnnn : nnnn
```

nnn - Enter the input and output revolution values for the gear ratio.

Access Method	Identification	Permissible Values
CTA10-1 or BTC06-1	AS04	1 - 9999 rpm (Input Revolutions) 1 - 9999 rpm (Output Revolutions)
VisualTRANS	S-0-0121 S-0-0122	Same as above
Serial Protocol	DP 4.121 DP 4.122	Same as above
		Default: 1:1

The value of any gear ratio in the spindle system is entered here. This parameter does not allow any decimal points. It does allow for up to four digits as the gear ratio.

If a second encoder is not used or speed limits are not under consideration, it is not necessary to program a gear ratio, even if one is being used.

Enter the values to be used for this parameter. Press ENTER when the data is confirmed and the TRANS 01-D will store the data for this parameter and step to the next parameter.

Tip: If you make a mistake entering a value for an option within this parameter, use the left and right arrow keys on the CTA10-1 and enter the correct value. Using the ESC key will back you up to the previous parameter.

AS05 Bipolar Torque Limit

```
AS05 Bipolar
Torque Limit %
     nnn.n
```

nnnn - Enter the value, in percentage, for the selected torque to be used.

This value is a percentage of the system's continuous torque. The bipolar torque limit value determines the maximum allowable torque in either direction.

Access Method	Identification	Permissible Values
CTA10-1 or BTC06-1	AS05	0 - 400%
VisualTRANS	S-0-0092	0 - 3276.7
Serial Protocol	DP d.92	Same as above
		Default: 400%

Enter the value to be used for this parameter. Press ENTER when all data is confirmed and the TRANS 01-D will store the data for this parameter and step to the next parameter.

Tip: If you make a mistake entering a value within this parameter, press the ESC key on the CTA10-1 and enter the correct value. However; if you realize that you entered an incorrect value after pressing ENTER and proceeding to the next parameter, use the down arrow to return to the previous parameter, press ENTER and correct any errors.

AS06 Axis Gains

```
AS06 Axis Gains
→1.Set Gains
 2.Load Default
```

```
AS06 Axis Gains
KV          nn.nn
P-Gain        n.n
V-Loop INT  nnn.n
```

nnn - Enter the gain factors to be used for the appropriate axis.

Access Method	Identification	Permissible Values
CTA10-1 or BTC06-1	AS06	0.1 - 29 (KV) 0.01 - 655.35 (Proportional Gain) 0 - 6553.5 (Velocity Loop Integral Reaction Time)
VisualTRANS	S-0-0104 S-0-0100 S-0-0101	Same as above
Serial Protocol	DP d.104 DP d.100 DP d.101	Same as above
		Default: dependent on attached servo system

The screen on the left comes up first asking the programmer if they want to set the gains themselves, or if they want to use the standard system gains.

If the programmer chooses “Set Gains”, the following options are given:

- KV - The position loop gain desired should be entered here. Default value is 1. The K_V –factor determines the gain of the position loop regulator throughout the entire velocity range.
- P-Gain - The proportional gain should be entered here. This is a proportional gain only for the velocity loop regulator.
- V-Loop INT - The velocity loop integral reaction time should be entered here. This value relates the velocity loop proportional gain, Kp to the velocity loop integral gain by the ratio:

$$K_i = K_p / t_n$$

Where tn is the velocity loop integral reaction time.

The definition of t_n is the time when the K_i gain equals the K_p gain.

If “Load Defaults” is selected, the TRANS 01-D will automatically set the default systems gains in the spindle drive. These gains are based on the assumption that the inertia relationship of motor to load is 1:1. The CTA10-1 will tell the user when it is loading the default gains.

```
Loading...
Please Wait!
```

After the default gains are loaded, they will be displayed and the programmer can still modify the value or press ENTER for each value until the next parameter is displayed.

Tip: If you make a mistake entering a value within this parameter, press the ESC key on the CTA10-1 and enter the correct value. However; if you realize that you entered an incorrect value after pressing ENTER and proceeding to the next parameter, use the down arrow to return to the previous parameter, press ENTER and correct any errors.

AS07 Ramp

```
AS07 Ramp

Ramp:          nnn.
        UPM
```

nnnn - Enter the value to be used as the specified acceleration/deceleration ramps.

UPM - The unit per measure chosen in Parameter Aa02 will be displayed here for the programmer's reference. This is displayed for reference only and cannot be changed in this parameter. The units can only be changed in Parameter Aa02

Access Method	Identification	Permissible Values
CTA10-1 or BTC06-1	AS07	0 - System Max (max. acceleration) 0 - System Max (max. deceleration)
VisualTRANS	A-0-0021 A-0-0022	Same as above
Serial Protocol	AP a.21 AP a.22	Same as above
		Default: 200

The Ramp will be the rate used as the primary acceleration rate for this axis. The axis acceleration is limited to this value during a coordinated (interpolated) move. At the drive level, the acceleration capability is limited by the amount of peak torque that the drive and motor are rated for.

Enter the values to be used for this parameter. Press ENTER when all data is confirmed and the TRANS 01-D will store the data for this parameter and step to the next parameter.

Tip: If you make a mistake entering a value within this parameter, press the ESC key on the CTA10-1 and enter the correct value. However; if you realize that you entered an incorrect value after pressing ENTER and proceeding to the next parameter, use the down arrow to return to the previous parameter, press ENTER and correct any errors.

AS08 Speed

```
AS08 Positioning
Speed
   nnnn.nn   UM
```

```
AS08 Speed
     Maximum
   nnnn.n   UM
```

This parameter sets the positioning and maximum speeds at which the spindle will run.

Positioning Speed

If no spindle feedrate is programmed in a NC block, the positioning speed value entered in the Positioning Speed screen will be used.

Maximum Speed

This is the maximum spindle that the user can use in a NC part program block.

AS09 Directions

```
AS09 Directions
Velocity       n
Jogging        n
```

n - Enter a 1 or a 0 to select the direction for the specified function. See note below for Rotary operation.

Access Method	Identification	Permissible Values
CTA10-1 or BTC06-1	AS09	0 (CW) or 1(CCW) Velocity direction jogging direction
VisualTRANS	A-0-0309 A-0-0310	Same as above
Serial Protocol	AP a.309 AP a.310	Same as above
		Default: 0

The programmer will have the ability to select more than one option under this parameter. When you are at the option you want to enable, enter a 0 or a 1.

The direction of the motion can be changed here by toggling between 0 and 1. With a motion commanded in the positive direction (0), the TRANS 01-D will cause the motor to turn in a clockwise direction, when looking at the front of the motor shaft. If another direction is needed for any of the above functions, the direction change must be made here.

Note: When operating in Rotary mode, placing a 0 or a 1 here will Home the axis in the specified direction only. Placing a 2 here will cause the unit to always Home using the **shortest path** to Home. This will cause the axis to Home in either direction, depending on its position.

Pressing the ENTER key will step to the next parameter option.

Enter the values to be used for this parameter. Press ENTER when all data is confirmed and the TRANS 01-D will store the data for this parameter and step to the next parameter.

Tip: If you make a mistake entering a value within this parameter, press the ESC key on the CTA10-1 and enter the correct value. However; if you realize that you entered an incorrect value after pressing ENTER and proceeding to the next parameter, use the down arrow to return to the previous parameter, press ENTER and correct any errors.

AS10 Overload Factor

This Overload Factor parameter is only available when using DIAX02 (DDS02.1, DDS03.1, etc.) digital drives. However, when using a DIAX03 (DDS02.2, DDS03.2, etc.) or DIAX04 (HDD, HDS, etc.) digital drive, the Overload Factor is controlled and monitored by the drive. This parameter will still be displayed by the CTA10-1 but a second screen ("Not available for this Drive") will be displayed after pressing ENTER.

```
Parameter Number
For S-Axis(0-13)
 AS#=  10
:Overload Factor
```

Second screen displayed for DIAX02 Digital Drives

```
AS10 Overload
     Factor %
     nnnn
```

Second screen displayed for DIAX03 / 04 Digital Drives

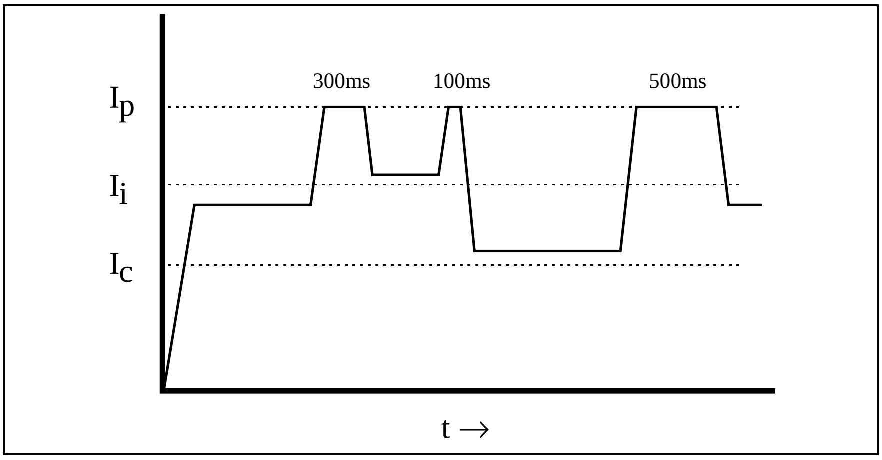
```
Not available
for this Drive
```

nnnn - Enter the percentage value for the Overload Factor you want to use for this axis.

Access Method	Identification	Permissible Values
CTA10-1 or BTC06-1	AS10	1 - 65535
VisualTRANS	P-0-0006	Same as above
Serial Protocol:	DP d.32774	Same as above
		Default: 100%

This parameter sets the allowable intermittent current (and torque) range of the servo system.

There are three important **current** levels to consider, continuous, intermittent, and peak. Theoretically, peak current is dependent upon the drive selection and should be available for 300 - 500 msec. However under load, the time that may be spent at peak current is affected by the intermittent current level and the switch-on time above or below this level: the more time spent above intermittent current level, the less time is available at peak current. Conversely, the more time spent below the intermittent current level, the more time is available at peak current. Also, the higher the intermittent current level, the less time available for peak current.



Time spent at peak current is limited because there is a limit to the drive's ability to dissipate heat. Thus generally speaking, according to the following equation:

Intermittent Current = Continuous Current x Overload Factor

the higher the overload factor, the lower the maximum available torque (which is dependent upon available peak current).

For more information on these relationships, refer to the DDS 2.10 SERCOS Drive Application Manual.

Enter the value to be used for this parameter. Press ENTER when all data is confirmed and the TRANS 01-D will store the data for this parameter and step to the next parameter. If you make a mistake entering this value, press the ESC key and enter the correct value.

Tip: If you make a mistake entering a value within this parameter, press the ESC key on the CTA10-1 and enter the correct value. However; if you realize that you entered an incorrect value after pressing ENTER and proceeding to the next parameter, use the down arrow to return to the previous parameter, press ENTER and correct any errors.

AS11 Control Windows

```
AS11 Control
     Windows
Position Window
 nnnnnn.nn   (UM)
```

```
AS11 Control Win
MaxDev n.nnnn
Monitoring
Window nn.nnn  %
```

```
AS11C ControlWin
Zero VelocIty
WIndow %
   nn.nnn      UM
```

nnnnnn.nn - Enter the value to be used for determining your position Window.

nnnn.n% - Enter the value to be used for your Monitoring Window.

UM - The unit of measure chosen in Parameter Aa02 will be displayed here for the programmer's reference. This is displayed for reference only and cannot be changed in this parameter. The units can only be changed in Parameter Aa02

Access Method	Identification	Permissible Values
CTA10-1 or BTC06-1	AS11	0 - 214748.3647 (In-Position Window) 0 - 6553.5 (Monitoring Window)
VisualTRANS	S-0-0057 S-0-0159	Same as above
Serial Protocol	DP d.57 DP d159	Same as above
		Default: *0.001 (In-Position Window)* *10% (Monitoring Window)*

Position Window: When the axis position is found to be within the limits defined by this parameter, it is considered to be "in position" and the drive will acknowledge.

Monitoring Window: The maximum following error which is allowed by the position loop can be defined in the monitoring window. When the position error exceeds the maximum window value, the drive sets an excessive position error in Class 1 Diagnostics, IDN S-0-0011.

This is also shown on the H1 display as a "28" error, Excessive Deviation. When this error occurs, the maximum deviation which was encountered is stored in parameter P-0-0098 in percent, with 100% = 360.

A procedure for setting this parameter is as follows:

1. Set this parameter (S-0-0159, Monitoring Window) to 50%.
2. Run the axis with its maximum velocity and acceleration for the application.
3. Read the maximum model deviation from IDN P-0-0098.
4. Multiply the max. model deviation by 2 and enter into parameter S-0-0159.

Zero Velocity Window: This window sets the minimum velocity in which the motor operates. If the motor operates below this value, it is considered to be at zero velocity.

If the motor velocity is below this value, the “Spindle at 0 Speed” output will turn on (high).

AS12 External Encoder Control Window

```
AS12 Ext.Encoder
Control Windows
     (UM)
      n.nnnn
```

nnnn - Enter the value to be used for the maximum position difference to be allowed. Leaving the value of this parameter at 0.0000 disables the monitoring function.

Access Method	Identification	Permissible Values
CTA10-1 or BTC06-1	AS12	0 - 214748.3647
VisualTRANS	P-0-0120	Same as above
Serial Protocol	DP d.32888	Same as above
		Default: 0.0

When an external encoder is connected to the digital spindle drive and used as the primary positioning device, the Indramat spindle drive constantly monitors the difference between the external encoder position and the motor encoder position for an additional error check on the machine mechanics. This monitoring is designed to show that the relationship between the motor encoder and the external encoder has changed. If the position difference between these two encoders exceeds this value, the digital drive will issue a “36” error. The error will alert the user to this condition. The cause of the difference can be loose mechanics or a slipping drive belt.

Enter the value to be used for this parameter. Press ENTER when all data is confirmed and the TRANS 01-D will store the data for this parameter and step to the next parameter. If you make a mistake entering this value, press the ESC key and enter the correct value.

Tip: If you make a mistake entering a value within this parameter, press the ESC key on the CTA10-1 and enter the correct value. However; if you realize that you entered an incorrect value after pressing ENTER and proceeding to the next parameter, use the down arrow to return to the previous parameter, press ENTER and correct any errors.

4 Programming

This chapter contains:

- Application programming requirements that outline certain procedures that must be followed to ensure proper operation of the TRANS 01-D system.
- A screen flow structure for each function available when programming a NC Block.
- A discussion of each function as it pertains to that function along with references to more detailed information.
- An example of a recommended programming style on page 4-43
- Overview of all possible G code functionality that will be available with the TRANS 01-D.

4.1 Program Structure and Timing Considerations

The TRANS 01-D is part of a distributed architecture. Multiple processors and tasks operate asynchronously to control the logic, sequencing, and motion functions of a machine. They each pass commands and status by writing information into memory locations. When another task or processor needs the information, it reads the memory location. There is an inherent time delay between when data is written and when another task is ready to read and use that data. This exists in all distributed systems. For example, in any PLC the I/O status is transferred between the I/O modules and the processor memory by an I/O task or dedicated I/O processor hardware. The status is not used until the logic processor completes its logic scan and updates its I/O image.

To get the required response from the overall machining system, whenever there must be communication or handshaking between tasks, it is necessary to consider the time required for each of the various parts of the system to execute their functions in sequence.

Tasks in the process that require time to execute:

- Between the PLC and TRANS 01-D there is transport delay due to I/O hardware (de-bounce and switching time) or fieldbus communication transmission time.
- Within the PLC there is I/O scan time to get data to the processor and back to the TRANS 01-D.
- Within the PLC, there is program execution time (scan time).
- Within the TRANS 01-D, there are multiple tasks triggered at various time intervals. Some are running at lower priorities and can be interrupted requiring more than one time interval to complete a task.
- Within the TRANS 01-D, there is a motion task that lays out the actual position and speed commands to each axis to make the required moves of the machine. These calculations use the speed and acceleration parameters set in the control and the drive.
- On the machine, the actual time to make moves is effected by the weight, inertia, allowable acceleration, and maximum speed of the equipment. Various tuning parameters in the control and drives effect the time required for each move.

In practice, it is very difficult to calculate how all of these timing factors interact. Typically, the programmed distance, speed, and acceleration rate of the required moves are used to calculate the motion time of the cycle. The time for any other non-motion functions (like hydraulic clamping cylinder motion) is added. Then a factor based on previous experience is added for the program execution and communication times.

Once the system is running and optimization of individual slowest stations is required to improve cycle time, measurements must be taken to determine how the various factors effect that particular process. The “oscilloscope function” of the digital drives and the TRANS 01-D control provides a tool for that optimization measurement.

The following time estimates may be helpful in analyzing and understanding the profiles:

- From receipt of the start input until the control goes from stopped to running state is typically 150 msec.
- The TRANS 01-D executes its motion program (‘NC program”) as an interpreted program. It converts the program from a table of ASCII coded block data to the actual motion commands sent to the drive each time a block is executed. This makes it easy for the user to view and edit the program compared to a compiled program method. However, any “G62” sequence that must be executed as a blended velocity profile is pre-calculated to ensure that it will execute without hesitation during the move. The time to set up the blocks occurs before the first move in the sequence and is typically 100 msec plus 50 msec per block in the sequence. The G62 sequence is intended to get a smooth velocity profile when transitioning from rapid to cutting feedrate or when required to get the proper surface finish on a series of moves during cutting. It is not intended to do complex cutting profiles or to make piecewise polygon approximations to a circular profile.
- Any block that has motion programmed takes a minimum of 100 msec to execute the actual move. If a very short block is programmed (less than 100 msec at the programmed speed or even zero motion), the speed will be reduced so that it will take 100 msec to execute. Note that this is not a time delay added to every block – just a minimum. In a normal program, each move will be long enough to take more than the minimum. Delays are only introduced if there are successive blocks programmed to the same point or nearly identical point. This should be avoided. For example, to remove an intermediate point in a structured program, use block delete to remove the block data and renumber the following block rather than just editing the intermediate block to the same endpoint as the block following it.
- Any handshake that causes the execution of the program to change state (go between stopped, running, waiting, or paused) requires passing signals between tasks in the system that can take 150 msec to complete.
- Execution of the Jump and Stop command to end a program requires state changes and passing signals between tasks that can typically take 100 msec. To avoid delay, the next phase of the cycle (for example, starting the part transfer after the station operation is complete) should be allowed to start based on an auxiliary output and / or a position based signal like “Transfer Enable”. This takes the task shutdown time off of the critical path for the overall machine cycle.

General suggestions for improving cycle time:

- Reduce the number of times that the control must be started and stopped within one machine cycle. Try to make the normal automatic cycle execute as a single program sequence in the TRANS 01-D. This maximizes the benefit of the distributed control architecture – each part of the system working independently to complete its task. If every individual move is programmed as a separate sequence that must be requested and started by the PLC, the inherent delays will be multiplied.
- Avoid executing blocks with the same command repeated in successive blocks. Even “No Operation” blocks take time to interpret (approximately 10 msec each). Remove them from the main flow of

the program or use jumps to move over them without executing. The "No Operation" command is a convenient placeholder that the control can execute through during program development and debug, but a well designed final program should have no need for "No Operation" blocks. They should not be used to fill all unused blocks since they defeat the error checking for error "503 Executing empty block" if a programming error causes a jump to the wrong block.

- Tune for the highest gains and acceleration rates that are acceptable to the machine and process. If the exact position is not critical to the process, increase the "in position" window. The drive will still go to the programmed position, but the transition to the next program block can occur as soon as it is within the window. Since the move slows as it approaches the endpoint, the closer it is required to get, the longer it will take. For example, if a station is doing through-hole drilling or boring, it probably does not need an in-position window of 0.010 mm.

4.2 Application Programming Requirements

Remote operation of the TRANS 01-D via the Operator Interface requires that certain rules for machining, and reverse movements must be established and scrupulously observed by the programmer. This is necessary to insure that program execution will always be started in the proper manner, independent of unexpected events and actions, and that the system will always remain controllable in all operating situations via the Operator and Cycle Interfaces. If the programming rules are not followed, the TRANS 01-D will, depending on the type of violation, refuse to issue a Ready signal for the start of automatic operation, or it will not be possible to execute a homing command or manual operation selected from the Operator Station. The various programming situations and the requirements for each are summarized in the following sections.

Start of the Program

All machining programs must start with NC Block 000. If several different machining programs are to be written, branching must be accomplished such that an unconditional or conditional jump from NC Block 000 be executed to jump to the start of the program.

First Positioning

In order to assure that machining programs will be executed with a correct absolute reference under all circumstances, the first positioning in a machining program should be programmed in Absolute Positioning Mode.

End of the Program

The TRANS 01-D user has the ability to program Incremental and Absolute positional moves. These moves can be executed in program NC Blocks With or Without Lag Finishing. The G62 (Without Lag) command in a program NC Block is used for velocity contouring between the current NC Block and the next program NC Block. Because of this contouring, the last motion NC Block in a profile, must be programmed With Lag Finishing (G61). Additionally, when a NC Block is programmed using Without Lag Finishing (G62), it cannot contain any NC Block jumps.

All programs must be terminated with a Jump To Block 000 And Stop command (JS000). This applies equally to machining programs, reverse programs, and tool change programs. It is very important that all programs end with a Jump To Block 000 And Stop command. The TRANS 01-D uses this signal for many items, such as monitoring of thermal overloads, Home Switch Monitoring, etc.

4.3 Programming Capability Description

Up to 200 programmable NC Blocks are available from the TRANS 01-D. Refer to Chapter 3, Parameters, for a description of TRANS 01-D parameters.

4.4 Programming with CTA10-1 and BTC06

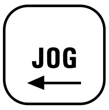
The CTA10-1 and BTC06 use conversational programming for easy and understanding of each function being programmed. The user is guided through a series of screens that displays the available functions.

Tip: In order to protect the investment of time spent programming a large or even small program, the user should upload TRANS 01-D programs using an interface like VisualTRANS and store them for safe keeping.

Enabling the CTA10-1

Enabling or Disabling the CTA10-1 arises when there is a conflict of control between the Host device (CTA10-1) and the line controller (PLC) over common signals shared by both devices.

These signals are the:

Jogging 

, **Programming** 

, and **Parameter** 

keys when these same functions exist as inputs in the I/O configuration that is being used.

The CTA10-1 can either be enabled or disabled as an interface for purposes of programming NC Blocks and jogging axes.

I/O Type Function	DEA 28.1M I/O Card	DBS 03.1M I/O Card	DEA 04.x I/O Card	DEA 04.x and DEA 05.x I/O Cards
Jogging	yes	yes	no	yes
Programming	yes	yes	no	yes
Parameter	yes	yes	no	yes
Set Absolute Measuring Point	yes	yes	no	yes
Hand Mode	yes	yes	no	yes
Single Block	no	yes	no	no
Cycle Start	no	yes	no	no
Cycle Stop	no	yes	no	no

Table 4-1: Functions controlled by Host Enable

Note: In order to enable the CTA10-1, the TRANS 01-D system must **NOT** be in Auto or Hand mode. Switch the system to Manual mode before proceeding with this procedure. Refer to the description of Host Enabled output on page for a complete list of conditions that must be met to change Host Enabled.

The following screen indicates that the system is in Auto mode.

```
A  N000  X-Axis
U  Act=   0.00000
T  Dev=   0.00000
O  Vel=   0.00000
```

If the following screen appears when the <**N**> program key is pressed, use the following procedure to enable the CTA10-1 for programming.

```
GO  TO  MENU  MODE

TO  ENABLE  CTA10!
```

1. Press the <**Menu**> key on the CTA10-1 to display the Manual Mode screen.

```
Manual  Mode
 4.SIngle  Cycle
 5.Set  Abs.mp
→6.CTA  10  OFF
```

Press 6 on the numeric keypad or scroll down using the arrow keys and press **ENTER**

2. The next screen will ask if you want to enable the CTA10-1. Press **ENTER** for yes.

```
Enable  CTA  10  ?

ESC=NO,ENTER=YES
```

3. The password screen is designed to allow only authorized and trained personnel to enable or disable the CTA10-1. From the password screen, enter "(5 6 7 8)" and press ENTER

```

 Password  ____
Key  in  Password
and  Press  ENTER
```

Once these steps are completed, the CTA10-1 is enabled and can be used for programming NC Blocks, modifying parameters and jogging a selected axis. To disable the CTA10-1, follow the same procedure.

4.5 Programming Screens

This section will describe the various methods that can be used for reviewing and programming TRANS 01-D programmable NC Blocks. The HMI interfaces that are capable of displaying the screens contained in this section are the CTA10-1 and the BTC06. In regards to programming, the CTA10-1 will be referred to throughout this section. However, the BTC06 contains the same screen structure. Refer to Chapter 2, Human / Machine Interface, for a description of these interfaces.

For protection against unauthorized changes to programmed NC Blocks, a Program password is used to enable Program Entry/Edit modes.

The following table contains the basic CTA10-1 function keys used for/during programming.

Key	Function	Key	Function
N	In Auto mode, the <N> key displays the current NC program block in Standard Machine G-code. In Manual mode, this key allows review or editing of the current program, block by block.		The <Save> key saves the current program block.
AXIS	The <Axis> key is used to select an axis for programming or displaying.	Diag	In Auto mode, as a program function, the <Diag> key displays the status of the function being perform by the current NC block. When a fault occurs, use the <Diag> key along with the arrow keys to get more info.
	In Auto mode, the <Tool Offset> key allows viewing of tool correction values. In Manual mode, this key allows the user to enter tool correction values.	1	In Manual mode, the <Start> key starts the cycle. In Auto mode, this key is disabled. In both modes, this key's LED is lit to indicate a program is running.
ENTER	When editing a program, press this key load the data and move the cursor. When editing tool correction values, press this key to load the new value.	ESC	The <ESC> key clears any data in a numerical field, or backs up to the previous menu.
↑	Within menus, the arrow keys are used to scroll up or down.	9	Numerical keys are used to select a numbered menu item, and enter numerical values.

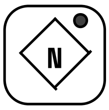
Table. 4-1: Basic programming function keys

Displaying Program Blocks

Before NC blocks can be displayed, the system must **NOT** be in Auto mode. Switch the system to manual mode before proceeding. Use the following procedure to display programmed NC Blocks:

N

1. Switch the TRANS 01-D system into manual mode. The switching of Auto to Manual modes is controlled by the external PLC via the I/O interface connected to the TRANS 01-D. In auto mode, NC program blocks being executed can be displayed by pressing the <**N**> program key .



2. Once the TRANS 01-D system is in manual mode, press the <**N**> (programming) key to switch to programming mode and the following screen will be displayed.

```
Programming Mode
  1.Program Entry
→2.Review
  3.Quit
```

3. Select **Review** by either entering **2** from the numeric keypad or use the arrow keys to scroll to Review and press **ENTER**. The item that is ready to be selected will be flashing. If you accidentally choose the wrong item, press the **ESC** key on the CTA10-1 to return to the previous screen.
4. After selecting Review, enter the desired NC Block number you wish to display in the following screen and press ENTER.

```
Block Number?

N= 001
```

For example, you are going to review NC Block **N001** that performs the following procedure.

Position the Y axis to "0.0" at a feedrate of "40" with lag and wait for an I/O acknowledgment of "0000000" (7 bit structure for DEA28 and Interbus-S DBS card). Standard machine G-code appears as follows:

Standard Machine G-code

N001 G01 G90 G61 Y0 F40 M0000000

N001	= NC Block number
G01	= Positioning command
G90	= Absolute position move
G61	= With Lag finishing
Y0	= Y axis move to position 0
F40	= Feedrate of 40 units per measurement
M0000000	= DBS I/O configuration, 0 = off

VisualTRANS will also display NC program blocks in standard machine G-code.

CTA10-1 Conversational Programming

Since the CTA10-1 uses conversational screens for programming NC blocks, viewing the same NC program block will appear as follows.

```
N001 POSITIONING
→1.Absolute
  2.With Lag
  3.X=
```

Using the down arrow key to scroll will display the remaining information within the POSITIONING screen. Since the CTA10-1 can only display four lines of text at a time, the following is simply an illustration of all the functions programmed for the NC block being reviewed.

```
N001 POSITIONING
→1.Absolute
 2.With Lag
 3.X=
 4.Y=0.0
 5.Z=
 6.F=40
 7.T=
 8.No Spindle
 9.M=0000000
10.No Jump
```

NC Block # including main function

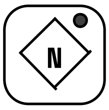
1. Absolute position move
2. With Lag finishing
3. No X axis position move requested
4. Y axis move to position 0.0
5. No Z axis position move requested
6. Feedrate of 40 units per measurement
7. No tool correction programmed
8. No Spindle Function active
9. DBS I/O configuration, 0 = off
10. No requirements for proceeding to next block

To view any other NC Block, press the **ESC** key to return to the Programming Mode screen, select Review once again and enter the next block number. To exit programming mode, press the **ESC** key twice.

Program Entry Mode

NC program block can only be programmed in manual mode. Switch the TRANS 01-D system to manual mode before proceeding. The TRANS 01-D Program Entry screens are password protected from unauthorized modifications. Use the following procedure to display and allow entry to the Program Entry screens.

Note: For multi-axis applications, each axis must be selected using the <**AXIS**> key before any programming can begin. Each axis used with the TRANS 01-D system must be selected and programmed individually.



1. Once the TRANS 01-D system is in manual mode, press the <**N**> (programming) key to switch to programming mode and the following screen will be displayed.

```
Programming Mode
→1.Program Entry
 2.Review
 3.Quit
```

2. Select **Program Entry** by either entering **1** from the numeric keypad or use the arrow keys to scroll to Program Entry and press **ENTER**. The item that is ready to be selected will be flashing. If you accidentally choose the wrong item, press the **ESC** key on the CTA10-1 to exit programming mode and press the <**N**> key once again.
3. On the Password Screen, enter the password (1234) and authorization to the current program blocks will now be accessible.

```
Programming Mode
 Password ____
Key in Password
and  ress ENTER
```

Once complete, the LED on the <**N**> program key will light up and the following screen will be displayed with the first item, **Program**, flashing.

```
Programming Mode
→1.Program
 2.Edit
 3.Quit
```

4. From the previous Programming Mode screen, the user has the option to create a new program block by selecting **Program** (**1**), **Edit** an existing program (**2**) or simply **Quit** (**3**) out of Program Mode.

Warning: When **1. Program** is selected, care must be taken not to accidentally program over an existing program block. The TRANS 01-D will not alert the user when overwriting an existing program block.

4. Whether the user is creating a new program or editing an existing program, use the CTA10-1's touch pad to enter the number of the NC Block that will be programmed. The TRANS 01-D contains 200 NC Blocks available for programming, numbered from 0 to 199.

```
Block Number?

N= 001
```

5. The next screen will list the possible programming functions that are available in the TRANS 01-D for each NC Block.

```
N001
→1.Positioning
 2.Dwell Time
 3.Aux.Function
```

Using the down arrow key on the CTA10-1 will display the remaining options available in this screen. Since the CTA10-1 can only display four lines of text at a time, the following is simply an illustration of all the functions available for programming and editing an NC Block.

```
N001
→1.Positioning
 2.Dwell Time
 3.Aux.Function
 4.Special Func
 5.Home Axis
 6.To Pos.Stop
 7.Spindle Func
 8.AF Switching
 9.Tool Corr.
 10.No Operation
```

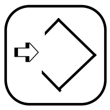
- Note that choice 9. Tool Correction was added in CTA release 06V26 / BTC06 release 01V26. Prior to that, choice 9 was No Operation.

The following sections will illustrate each function and the screens associated with them, along with an example of a typical NC program block for that function.

Positioning (NC Code G01)

In keeping with the TRANS 01's philosophy of programming, this positioning function allows programming of axis movements in a very logical step-like manner for the programmer. The Positioning function allows the user to program a given axis for linear or rotary motion. The positioning function contains ten primary screens for programming the position of an axis. The TRANS 01-D automatically progresses to the next screen when a choice has been made in the current screen.

To make a selection from a particular screen either select the number corresponding to your choice or arrow down to your choice and press ENTER. When all of the Positioning choices are selected press the "Save Block" key to save the NC Block.



Save Block Key

Select Positioning from the Primary Function selection screen to begin this NC program block.

Primary Function Selection Screen

```
N001 Function?
→1.Positioning
 2.Dwell Time
 3.Aux.Function
```

Screen 1 allows the user to select whether to program the position in **Normal** mode where a feedrate will be entered later in this program block, or whether to program in **Rapid** mode where the feedrate for the move is automatically programmed from Parameter Aa10 (Max Axis Speed.)

Screen 1:

```
N001 POSITIONING
→1.Normal
 2.Rapid
```

Screen 2 determines the type of positioning. This positioning menu allows movement to be programmed in either an Absolute (G90) or an Incremental (G91) mode.

In **Absolute** positioning (G90), all movements of the slide are made to some absolute position based on the machine reference position. Thus, if the slide is at +5 inches, a command to travel to +6 results in a 1 inch feed in the positive direction.

When selecting **Incremental** positioning (G91) the slide will travel the programmed distance from its current position in the specified direction.

Screen 2:

```
N001 POSITIONING
→1.Absolute
 2.Incremental
```

Screen 3 allows movement to be programmed either Without Lag (G62) or With Lag (G61). **Without Lag** Finishing (G62) specifies that the velocity profile will be contoured from one NC Block's feedrate to the next NC Block's feedrate to avoid a stoppage of motion between NC Blocks.

With Lag Finishing (G61) specifies that the axis must be in position before any miscellaneous functions remaining in the NC Block are executed or before the next NC Block is executed.

Screen 3:

```
N001 POSITIONING
 1.Without Lag
→2.With Lag
```

Screen 4 allows the **Destination** (distance) of the axis to be specified (this example shows the X-axis.) The CTA10-1 will display each servo axis configured in process parameter P02 after each entry. Using the numeric keypad on the CTA10-1, enter the distance of travel for the selected axis.

Note: Before a value is entered in this screen, recall the type of positioning selected in screen 2 (Absolute or Incremental.) Also the value entered is based on the units (inches or metric) programmed in parameter Aa02 (Units.)

Screen 4:

```
N001 POSITIONING
   Destination
 X=
```

```
N001 POSITIONING
   Destination
 Y=
```

```
N001 POSITIONING
   Destination
 Z=
```

Screen 5 allows movement of a rotary axis to be further defined by the direction of travel to a desired position. This screen appears after the destination screen (Screen 4 above) for an axis that is configured as a rotary axis (choice 4 – Unit/Rev.) in parameter Aa02 Units. It is not displayed for non-rotary axes. This option only effects the motion of G90 (absolute) type moves but is programmed with all rotary axis moves. Only one type of rotary positioning direction can be selected. The choices are Rotary, Shortest Path (**G36**), Positive Direction (**G37**), Negative Direction (**G38**).

Note: This screen becomes active when Axis parameter Aa02 (Units) is selected with Units / Rev.

Screen 5:

```
N001 POSITIONING
→1.ShortPath,G36
 2.Pos Dir, G37
 3.Neg Dir, G38
```

Screen 6 (**Feedrate**) is not available if "**Rapid"** has been selected in screen 1. This screen allows the user to enter a value that specifies what speed will be used to reach the required position entered in screen 5 (Destination) for all three axes if configured. If you attempt to select a feedrate greater than the parameter specified (Aa10) a fault will be issued.

Screen 6:

```
N001 POSITIONING
 Feedrate
 F=
```

Screen 7 (Tool Correction) allows for activation of pre-programmed tool corrections to be entered for compensations in tool wear. The value entered in this screen represents an address within the Tool Correction register table not contained within this program block. Refer to Tool Corrections on page 4-71 for more information.

Screen 7:

```
N001 POSITIONING
 Tool Correction
 T= x1
```

Tool Correction is entered in a two-digit format. The number entered represents a selection within the Tool Correction register table for each axis, not including the spindle axis. Nine tool correction registers are available per axis, Tx1 - Tx9. The first number (x) represents the axis, while the second number (1-9) indicates a selection from a list of nine pre-programmed choices.

Example: T = **x 1**

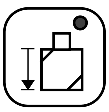
1-9 from register table
1 = X-axis
2 = Y-axis
3 = Z-axis

Tool Correction Register values are entered through the CTA10-1 keypad or through the RS232 port.

Setting Tool Correction Register Values

Use the following procedure to enter Tool Correction register values.

1. Press the <**AXIS**> key and select the axis to contain tool correction register values. Each axis can contain tool correction values.



1. Press the Tool Correction key on the CTA10-1 to enter values for the selected axis. Select the register address by scrolling with the arrow keys and press ENTER. In the Tool Correction screen, enter the value for the selected register and press ENTER. The maximum value allowed is limited by axis parameter **Aa15** (Tool Correction.) The values in these registers can be positive (+) or negative (-). Positive values will be assumed if no sign bit is entered along with the register's value.

```
→Tx1=0.250000
 Tx2=0.000000
 Tx3=0.000000
 Tx4=0.000000
```

```
Tool Correction
 (Max:1.000000)
 Tx1=   0.250000
```

After setting tool correction register values, they can now be addressed in screen 7 above.

When the TRANS 01-D is operating, the correction value in the specified tool correction register will be added to the programmed position value, i.e., the target position of the TRANS 01-D is the sum of the programmed position and the correction value.

If the total distance programmed exceeds the Overtravel limits of axis parameter **Aa06**, the TRANS 01-D will issue the soft fault "Axis position is out of bounds".

Zero setting of the tool correction value is accomplished by specifying tool correction register Tx0. When a tool correction register is addressed in a NC block, the compensation or correction is made in that block and will remain throughout the program until it is cleared with Tx0. Tx0 is only used to clear the value in the correction register and cannot be used as an actual tool offset value.

Screen 8 and sub-screens are only displayed if a spindle axis has been configured in Process parameter P02 (Axis Configuration).

Screen 8:

```
N001 POSITIONING
→1.No Spindle
 2.Spindle-RPM
 3.SpIndle-POS
```

Sub-screens

```
N001 POSITIONING
 1.No Spindle
→2.Spindle-RPM
 3.SpIndle-POS
```

```
N001 POSITIONING
 Spindle-RPM
S=
```

```
N001 POSITIONING
 1.No Spindle
 2.Spindle-RPM
→3.SpIndle-POS
```

```
N001 POSITIONING
 Spindle-POS
P=
```

No Spindle: Select this option if no spindle movement is desired.

Spindle RPM: Enter the speed in rpm at which the spindle is to operate in this and subsequent NC Blocks, then press ENTER. The maximum spindle rpm range is +/-9999 rpm. However, your input range is limited (in both + and - directions) by the maximum rpm specified in the spindle axis parameter **SA1** (Max. Speed for DIAX01) or **AS08** (Max. Speed for DIAX02/03/04.) If the value of the mentioned Spindle axis parameter is reduced after your program is entered, the instructions will be executed, but the spindle speed will be limited by the new value, regardless of a higher speed entered in a program NC Block.

Spindle POS: Enter the position you want the spindle to orient. This must be a value between 0.1 - 359.9 degrees. Positions must be entered in degrees, with a resolution of 0.1 degree. This position is relative to the marker pulse on the spindle encoder. The position of the marker pulse is pre-defined as 0 degrees.

Screen 9 allows the user to program the Auxiliary Outputs. When the output is correctly acknowledged the program progresses to the next NC Block.

The outputs are programmed with the following states (conditions):

Auxiliary Output Definition:

M 0 1 2 1 1 1 1 1 1 0 0

0 - requires input to be always low

1 - requires input to be always high

2 - does not change the output and does not monitor the state of the input. I.e., if the input changes from 0 to 1, the TRANS 01-D will not issue a fault.

Screen 9:

```
N001  POSITIONING
  Aux.Function
 M=
```

Some of the Auxiliary outputs are acknowledgeable. This depends upon the selected I/O option in process parameter **P02**. Refer to Chapter 4, Process Parameters. The status of the corresponding input must match the status of the output or an Error and program pause will occur.

Screen 10 (Jump Command) allows the user to specify the type of jump command to issue at the end of the NC block. There are seven possible jump statements (Refer to Program Jumps on page 4-80 for a more detailed explanation on the functionality of each jump command). Once the appropriate jump command has been selected, then, if applicable, a sub-screen will appear. Enter the three-digit NC block address to where the program will jump.

Screen 10:

```
N001 POSITIONING
→1.No Jump
 2.JN uncond
 3.JU subroutine
```

Sub-screens

```
N001 POSITIONING          N001 POSITIONING
 1.No Jump                 Jump
→2.JN uncond              JN= 002
 3.JU subroutine
```

```
N001 POSITIONING          N001 POSITIONING
 2.JN uncond.              Jump
→3.JU subroutine          JU= 002
 4.JR reverse
```

```
N001 POSITIONING          N001 POSITIONING
 3.JU subroutine           Jump
→4.JR reverse             JR= 002
 5.JS jump&stop
```

```
N001 POSITIONING          N001 POSITIONING
 4.JR reverse              Jump
→5.JS jump&stop           JS= 002
 6.JC cond.
```

```
N001 POSITIONING          N001 POSITIONING
 5.JS jump&stop            Jump
→6.JC cond.               JC= 080:101
 7.JReturn.
```

Target NC Block

Cond Jump Inputs

```
N001 POSITIONING
 5.JS jump&stop
 6.JC cond.
→7.JReturn
```

Note: The following Block Repeat screen will appear at the end of every NC program block when programming. However, this option will not have any function with version 6 of the TRANS 01-D. It is being reserved for future development. When this screen appears, simply press ENTER to bypass this screen.

```
N001 POSITIONING
  Block Repeat
 E=
```

NC block edit screen

After the block repeat screen is bypassed, the CTA10-1 will display the NC block in edit mode. In the following screen the user has the option to except the NC block by pressing the Block save key or change and modify any line in the program block by selecting the number or using the arrow keys to scroll to the desired number and press ENTER.

```
N001 POSITIONING
→1.Absolute
 2.With Lag
 3.X=
```

Using the down arrow key to scroll will display the remaining information within the POSITIONING screen. Since the CTA10-1 can only display four lines of text at a time, the following is simply an illustration of all the functions programmed for the NC block being reviewed.

N001 POSITIONING	NC Block # including main function
→1.Absolute	1. Absolute position move
2.With Lag	2. With Lag finishing
3.X=	3. No X axis position move requested
4.Y=0.0	4. Y axis move to position 0.0
5.Z=	5. No Z axis position move requested
6.F=40	6. Feedrate of 40 units per measurement
7.T=	7. No tool correction programmed
8.No Spindle	8. No Spindle Function active
9.M=0000000	9. DBS I/O configuration, 0 = off
10.No Jump	10. No requirements for proceeding to next block

When the user has programmed all of the above options, the NC Block save key must be press to save the NC Program Block into memory and proceed to the next block.

Dwell Time (NC Code G04)

A dwell is programmed to allow time for some action to occur, such as a dwell programmed after a forward cutting motion to allow a drill to clean the hole and prevent burrs. Dwell times can be programmed from 0.01 to 99.99 seconds.

Select Dwell Time from the Primary Function selection screen to begin this NC program block.

Primary Function Selection Screen

```
N002  Function?
 1.Positioning
→2.Dwell Time
 3.Aux.Function
```

Screen 1 allows the user to enter a dwell time in seconds. Enter the decimal point in the proper position, or the TRANS 01-D assumes whole seconds. If an error is made when inputting an entry, press ESC (Escape) and re-enter the data.

Screen1:

```
N002 DWELL TIME

 F=        1.0
```

Screen 2 and sub-screens are only displayed if a spindle axis has been configured in Process parameter P02 (Axis Configuration.)

Screen 2:

```
N002 DWELL TIME
→1.No Spindle
 2.Spindle-RPM
 3.SpIndle-POS
```

Sub-screens

```
N002 DWELL TIME
 1.No Spindle
→2.Spindle-RPM
 3.SpIndle-POS
```

```
N002 DWELL TIME
 Spindle-RPM
S=
```

```
N002 DWELL TIME
 1.No Spindle
 2.Spindle-RPM
→3.SpIndle-POS
```

```
N002 DWELL TIME
 Spindle-POS
P=
```

Refer to Positioning, on page 4-14 for a description of available spindle options.

Screen 3 allows the user to program the Auxiliary Outputs. When the output is correctly acknowledged the program progresses to the next NC Block.

The outputs are programmed with the following states (conditions):

Auxiliary Output Definition:

M 0 1 2 1 1 1 1 1 1 0 0

0 - requires input to be always low

1 - requires input to be always high

2 - does not monitor the state of the input. I.e., if the input changes from 0 to 1, the TRANS 01-D will not issue a fault.

Screen 3:

```
N002  DWELL  TIME
   Aux.Function
  M=
```

Some of the Auxiliary outputs are acknowledgeable (This depends upon the selected I/O option in process parameter **P02**. Refer to Chapter 4, Process Parameters.) The status of the corresponding input must match the status of the output or an Error and program pause will occur.

Screen 4 (Jump Command) allows the user to specify the type of jump command to issue at the end of the NC block. Refer to Program Jumps, on page 4-80 for a description of available jump options.

Screen 4:

```
N002 DWELL TIME
→1.No Jump
 2.JN uncond
 3.JU subroutine
```

Sub-screens

```
N002 DWELL TIME
 1.No Jump
→2.JN uncond
 3.JU subroutine
```

```
N002 DWELL TIME
 Jump
JN= 003
```

```
N002 DWELL TIME
 2.JN uncond.
→3.JU subroutine
 4.JR reverse
```

```
N002 DWELL TIME
 Jump
JU= 003
```

```
N002 DWELL TIME
 3.JU subroutine
→4.JR reverse
 5.JS jump&stop
```

```
N002 DWELL TIME
 Jump
JR= 003
```

```
N002 DWELL TIME
 4.JR reverse
→5.JS jump&stop
 6.JC cond.
```

```
N002 DWELL TIME
 Jump
JS= 003
```

```
N002 DWELL TIME
 5.JS jump&stop
→6.JC cond.
 7.JReturn
```

```
N002 DWELL TIME
 Jump
JC= 090:110
```

Target NC Block

Cond Jump Inputs

```
N002 DWELL TIME
 5.JS jump&stop
 6.JC cond.
→7.JReturn
```

When the user has programmed all of the above options, the NC Block save key must be press to save the NC Program Block into memory and proceed to the next block.

Auxiliary Functions

Select Auxiliary Functions from the Primary Function selection screen to begin this NC program block.

Primary Function Selection Screen

```
N003  Function?
 1.Positioning
 2.Dwell Time
→3.Aux.Function
```

Screen 1 allows the user to program the Auxiliary Outputs. When the output is correctly acknowledged the program progresses to the next NC Block.

The outputs are programmed with the following states (conditions):

Auxiliary Output Definition:

M 0 1 2 1 1 1 1 1 1 0 0

0 - requires input to be always low

1 - requires input to be always high

2 - does not monitor the state of the input. i.e., if the input changes from 0 to 1, the TRANS 01-D will not issue a fault.

Screen 1:

```
N003 AUX.FUNC.
  Aux.Function
 M=
```

Some of the Auxiliary outputs are acknowledgeable. This depends upon the selected I/O option in process parameter **P02**. Refer to Chapter 4, Process Parameters. The status of the corresponding input must match the status of the output or an Error and program pause will occur.

Screen 4 (Jump Command) allows the user to specify the type of jump command to issue at the end of the NC block. Refer to Program Jumps, on page 4-80 for a description of available jump options.

Screen 4:

```
N003 AUX.FUNC.
→1.No Jump
 2.JN uncond
 3.JU subroutine
```

Sub-screens

```
N003 AUX.FUNC.
 1.No Jump
→2.JN uncond
 3.JU subroutine
```

```
N003 AUX.FUNC.
 Jump
JN= 004
```

```
N003 AUX.FUNC.
 2.JN uncond.
→3.JU subroutine
 4.JR reverse
```

```
N003 AUX.FUNC.
 Jump
JU= 004
```

```
N003 AUX.FUNC.
 3.JU subroutine
→4.JR reverse
 5.JS jump&stop
```

```
N003 AUX.FUNC.
 Jump
JR= 004
```

```
N003 AUX.FUNC.
 4.JR reverse
→5.JS jump&stop
 6.JC cond.
```

```
N003 AUX.FUNC.
 Jump
JS= 004
```

```
N003 AUX.FUNC.
 5.JS jump&stop
→6.JC cond.
 7.JReturn
```

```
N003 AUX.FUNC.
 Jump
JC= 100:101
```

Target NC Block

Cond Jump Inputs

```
N003 AUX.FUNC.
 5.JS jump&stop
 6.JC cond.
→7.JReturn
```

When the user has programmed all of the above options, the NC Block save key must be press to save the NC Program Block into memory and proceed to the next block.

Special Function - Adaptive Depth Control (NC CodeG08)

Adaptive Depth arises from the final depth of a positional move being dependent on the location of the part surface and not the referenced position of the motor encoder. This is made possible by using an external encoder to determine the final position. This form of positioning has the following advantages:

- It compensates for both drive train and work piece variations while the tool is actually performing the cut.
- Using incremental positioning it is possible to program distances relative to the face of the part.

Refer to Adaptive Depth Control (G08) on page 4-58 for more information.

Select Special Function from the Primary Function selection screen to begin this NC program block.

Primary Function Selection Screen

```
N004  Function?
 2.Dwell Time
 3.Aux.Function
→4.Special Func
```

Screen 1 (Distance) allows the user to set a total distance of deflection for the linear scale.

Screen 1:

```
N004 Adapt.Depth
   Destination
 X=       0.5
```

Note: Parameter Aa31 (Linear Encoder Prelimit) sets the minimum amount of deflection that must be seen on the external linear scale before this G08 program block is executed. Whatever the distance the encoder is deflected, (e.g., λ) and this G08 NC block begins to execute, the TRANS 01-D will move the axis a distance of $(0.5 - \lambda)$ under adaptive depth control to equal 0.5 total linear deflection at the end of this NC block.

Screen 2: Screen 2 (**Feedrate**) allows the user to enter a value that specifies what speed will be used for adaptive depth.

```
N004 Adapt.Depth
 Feedrate
 F=
```

Screen 3 (Tool Correction) allows for activation of pre-programmed tool corrections to be entered for compensations in tool wear. The value entered in this screen represents an address within the Tool Correction register table not contained within this program block. Refer to Tool Corrections, page 4-13 and 4-71 for a complete description.

Screen 3:

```
N004 Adapt.Depth
 Tool Correction
 T= x1
```

Screen 4 and sub-screens are only displayed if a spindle axis has been configured in Process parameter P02 (Axis Configuration.)

Screen 4:

```
N004 Adapt.Depth
→1.No Spindle
 2.Spindle-RPM
 3.SpIndle-POS
```

Sub-screens

```
N004 Adapt.Depth
 1.No Spindle
→2.Spindle-RPM
 3.SpIndle-POS
```

```
N004 Adapt.Depth
 Spindle-RPM
S=
```

```
N004 Adapt.Depth
 1.No Spindle
 2.Spindle-RPM
→3.SpIndle-POS
```

```
N004 Adapt.Depth
 Spindle-POS
P=
```

No Spindle: Select this option if no spindle movement is desired.

Spindle RPM: Enter the speed in rpm at which the spindle is to operate in this and subsequent NC Blocks, then press ENTER. The maximum spindle rpm range is +/-9999 rpm. However, your input range is limited (in both + and - directions) by the maximum rpm specified in the spindle axis parameter **SA1** (Max. Speed for DIAX01) or **AS08** (Max. Speed for DIAX02/03/04.) If the value of the mentioned Spindle axis parameter is reduced after your program is entered, the instructions will be executed, but the spindle speed will be limited by the new value, regardless of a higher speed entered in a program NC Block.

Spindle POS: Enter the position you want the spindle to orient. This must be a value between 0.1 - 359.9 degrees. Positions must be entered in degrees, with a resolution of 0.1 degree. This position is relative to the marker pulse on the spindle encoder. The position of the marker pulse is pre-defined as 0 degrees.

Screen 5 allows the user to program the Auxiliary Outputs. When the output is correctly acknowledged the program progresses to the next NC Block.

The outputs are programmed with the following states (conditions):

Auxiliary Output Definition:

M 0 1 2 1 1 1 1 1 1 0 0

0 - requires input to be always low

1 - requires input to be always high

2 - does not monitor the state of the input. I.e., if the input changes from 0 to 1, the TRANS 01-D will not issue a fault.

Screen 5:

```
N001 Adapt.Depth
  Aux.Function
 M=
```

Some of the Auxiliary outputs are acknowledgeable. This depends upon the selected I/O option in process parameter **P02**. Refer to Chapter 4, Process Parameters. The status of the corresponding input must match the status of the output or an Error and program pause will occur.

Screen 6 (Jump Command) allows the user to specify the type of jump command to issue at the end of the NC block. There are seven possible jump statements (Refer to Program Jumps on page 4-80 for a more detailed explanation on the functionality of each jump command). Once the appropriate jump command has been selected, then, if applicable, a sub-screen will appear. Enter the three-digit NC block address to where the program will jump.

Screen 6

```
N004 Adapt.Depth
→1.No Jump
 2.JN uncond
 3.JU subroutine
```

Sub-screens

```
N004 Adapt.Depth
 1.No Jump
→2.JN uncond
 3.JU subroutine
```

```
N004 Adapt.Depth
 Jump
JN= 005
```

```
N004 Adapt.Depth
 2.JN uncond.
→3.JU subroutine
 4.JR reverse
```

```
N004 Adapt.Depth
 Jump
JU= 005
```

```
N004 Adapt.Depth
 3.JU uncond.
→4.JR reverse
 5.JS jump&stop
```

```
N004 Adapt.Depth
 Jump
JR= 005
```

```
N004 Adapt.Depth
 4.JR reverse
→5.JS jump&stop
 6.JC cond.
```

```
N004 Adapt.Depth
 Jump
JS= 005
```

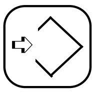
```
N004 Adapt.Depth
 5.JS jump&stop
→6.JC cond.
 7.JReturn
```

```
N004 Adapt.Depth
 Jump
JC= 110:111
```

Target NC Block   Cond Jump Inputs

```
N003 AUX.FUNC.
 5.JS jump&stop
 6.JC cond.
→7.JReturn
```

When the user has programmed all of the above options, the NC Block save key must be press to save the NC Program Block into memory and proceed to the next block.



NC Program Block
save Key

Home Axis

Example of a Home Axis NC program block at N195:

N195 G74 X.5 F100 M00000100000 JS000

Select Home Axis from the Primary Function selection screen to begin this NC program block.

Primary Function Selection Screen

```
N195  Function?
 3.Aux.Function
 4.Special Func
→5.Home Axis
```

Screen 1 (Destination) allows the user to set an offset distance for the axis to move to after it reaches home position.

Screen 1:

```
N195 HOME AXIS
   Destination
 X=   0.5
```

Screen 2 (**Feedrate**) allows the user to enter a value that specifies what speed the axis will travel to its designated homing position.

Screen 2:

```
N195 HOME AXIS
 Feedrate
 F=
```

Note: The TRANS 01-D gives the user two feedrate options for homing. If the axis is being referenced for the first time, it uses the feedrate entered in the Homing Speed parameter **Aa10**. If the axis has already been referenced, it uses the feedrate entered in this Homing block. This is done to allow a faster return to the home position after the axis has been referenced, but defaulting to a lower feedrate when seeking home for the first time.

Screen 3 and sub-screens are only displayed if a spindle axis has been configured in Process parameter P02 (Axis Configuration.)

Screen 3:

```
N195 HOME AXIS
→1.No Spindle
 2.Spindle-RPM
 3.SpIndle-POS
```

Sub-screens

```
N195 HOME AXIS
 1.No Spindle
→2.Spindle-RPM
 3.SpIndle-POS
```

```
N195 HOME AXIS
 Spindle-RPM
S=
```

```
N195 HOME AXIS
 1.No Spindle
 2.Spindle-RPM
→3.SpIndle-POS
```

```
N195 HOME AXIS
 Spindle-POS
P=
```

No Spindle: Select this option if no spindle movement is desired.

Spindle RPM: Enter the speed in rpm at which the spindle is to operate in this and subsequent NC Blocks, then press ENTER. The maximum spindle rpm range is +/-9999 rpm. However, your input range is limited (in both + and - directions) by the maximum rpm specified in the spindle axis parameter **SA1** (Max. Speed for DIAX01) or **AS08** (Max. Speed for DIAX02/03/04.) If the value of the mentioned Spindle axis parameter is reduced after your program is entered, the instructions will be executed, but the spindle speed will be limited by the new value, regardless of a higher speed entered in a program NC Block.

Spindle POS: Enter the position you want the spindle to orient. This must be a value between 0.1 - 359.9 degrees. Positions must be entered in degrees, with a resolution of 0.1 degree. This position is relative to the marker pulse on the spindle encoder. The position of the marker pulse is pre-defined as 0 degrees.

Screen 4 allows the user to program the Auxiliary Outputs. When the output is correctly acknowledged the program progresses to the next NC Block.

The outputs are programmed with the following states (conditions):

Auxiliary Output Definition:

M 0 1 2 1 1 1 1 1 1 0 0

0 - requires input to be always low

1 - requires input to be always high

2 - does not monitor the state of the input. I.e., if the input changes from 0 to 1, the TRANS 01-D will not issue a fault.

Screen 4:

```
N195 HOME AXIS
  Aux.Function
 M=00000100000
```

Some of the Auxiliary outputs are acknowledgeable (This depends upon the selected I/O option in process parameter **P02**. Refer to Chapter 4, Process Parameters.) The status of the corresponding input must match the status of the output or an Error and program pause will occur.

Screen 5 (Jump Command) allows the user to specify the type of jump command to issue at the end of the NC block. (Refer to Program Jumps on page 4-80 for a more detailed explanation on the functionality of each jump command).

Screen 5

```
N195 HOME AXIS
→1.No Jump
 2.JN uncond
 3.JU subroutine
```

Sub-screens

```
N195 HOME AXIS
 1.No Jump
→2.JN uncond
 3.JU subroutine
```

```
N195 HOME AXIS
 Jump
JN= 006
```

```
N195 HOME AXIS
 2.JN uncond.
→3.JU subroutine
 4.JR reverse
```

```
N195 HOME AXIS
 Jump
JU= 006
```

```
N195 HOME AXIS
 3.JU subroutine
→4.JR reverse
 5.JS jump&stop
```

```
N195 HOME AXIS
 Jump
JR= 006
```

```
N195 HOME AXIS
 4.JR reverse
→5.JS jump&stop
 6.JC cond.
```

```
N195 HOME AXIS
 Jump
JS= 006
```

```
N195 HOME AXIS
 5.JS jump&stop
→6.JC cond.
 7.JReturn
```

```
N195 HOME AXIS
 Jump
JC= 120:011
```

Target NC Block

Cond Jump Inputs

```
N195 HOME AXIS
 5.JS jump&stop
 6.JC cond.
→7.JReturn
```

When the user has programmed all of the above options, the NC Block save key must be press to save the NC Program Block into memory and proceed to the next block.

To Positive Stop

This function is typically used when it is necessary to position a slide against a positive mechanical stop. The slide will move to a distance and feedrate programmed in this block. Refer to Enable/Disable Feed To A Positive Stop (G75 & G76) on page 4-56 for a description of this function.

Select To Pos. Stop from the Primary Function selection screen to begin this NC program block.

Primary Function Selection Screen

```
N006  Function?
 4.Special Func
 5.Home Axis
→6.To Pos.Stop
```

Screen 1 allows the user to select whether to **Enable** (G75) or **Disable** (G76) the position to a positive stop function.

Screen 1:

```
N006 TO POS STOP
→1.Enable
 2.Disable
```

Screen 2 determines the type of positioning. This positioning menu allows movement to be programmed in either an Absolute (G90) or an Incremental (G91) mode.

In **Absolute** positioning (G90), all movements of the slide are made to some absolute position based on the machine reference position. Thus, if the slide is at +5 inches, a command to travel to +6 results in a 1 inch feed in the positive direction.

When selecting **Incremental** positioning (G91) the slide will travel the programmed distance from its current position in the specified direction.

Screen 2:

```
N006 TO POS STOP
→1.Absolute
 2.Incremental
```

Screen 3 (Destination) allows the user to enter the distance that will be used for travel of the Positive Stop function.

Note: This screen will display all of the servo axes configured in Process parameter **P02**. The user must determine which axis is to be used for positive stop and enter a distance for that corresponding axis letter, while simply bypassing the other axes by pressing ENTER on the CTA10-1

Screen 3:

```
N006 TO POS STOP
   Destination
 X=
```

Screen 4 (**Feedrate**) allows the user to enter a value that specifies what speed will be used to reach the required position entered in screen 3 (Destination.) If you attempt to select a feedrate greater than the parameter specified (Aa10) a fault will be issued.

Screen 4:

```
N006 TO POS STOP
 Feedrate
 F=
```

Screen 5 (Tool Correction) allows for activation of pre-programmed tool corrections to be entered for compensations in tool wear. The value entered in this screen represents an address within the Tool Correction register table not contained within this program block. Refer to Tool Corrections, page 4-13 and 4-71 for a complete description.

Screen 5:

```
N006 TO POS STOP
 Tool Correction
 T=
```

Screen 6 and sub-screens are only displayed if a spindle axis has been configured in Process parameter P02 (Axis Configuration.)

Screen 6:

```
N006 TO POS STOP
→1.No Spindle
 2.Spindle-RPM
 3.SpIndle-POS
```

Sub-screens

```
N006 TO POS STOP
 1.No Spindle
→2.Spindle-RPM
 3.SpIndle-POS
```

```
N006 TO POS STOP
 Spindle-RPM
S=
```

```
N006 TO POS STOP
 1.No Spindle
 2.Spindle-RPM
→3.SpIndle-POS
```

```
N006 TO POS STOP
 Spindle-POS
P=
```

No Spindle: Select this option if no spindle movement is desired.

Spindle RPM: Enter the speed in rpm at which the spindle is to operate in this and subsequent NC Blocks, then press ENTER. The maximum spindle rpm range is +/-9999 rpm. However, your input range is limited (in both + and - directions) by the maximum rpm specified in the spindle axis parameter **SA1** (Max. Speed for DIAX01) or **AS08** (Max. Speed for DIAX02/03/04.) If the value of the mentioned Spindle axis parameter is reduced after your program is entered, the instructions will be executed, but the spindle speed will be limited by the new value, regardless of a higher speed entered in a program NC Block.

Spindle POS: Enter the position you want the spindle to orient. This must be a value between 0.1 - 359.9 degrees. Positions must be entered in degrees, with a resolution of 0.1 degree. This position is relative to the marker pulse on the spindle encoder. The position of the marker pulse is pre-defined as 0 degrees.

Screen 7 allows the user to program the Auxiliary Outputs. When the output is correctly acknowledged the program progresses to the next NC Block.

The outputs are programmed with the following states (conditions):

Auxiliary Output Definition:

M 0 1 2 1 1 1 1 1 1 0 0

0 - requires input to be always low

1 - requires input to be always high

2 - does not monitor the state of the input. I.e., if the input changes from 0 to 1, the TRANS 01-D will not issue a fault.

Screen 7:

```
N006 TO POS STOP
  Aux.Function
 M=
```

Some of the Auxiliary outputs are acknowledgeable. This depends upon the selected I/O option in process parameter **P02**. Refer to Chapter 4, Process Parameters. The status of the corresponding input must match the status of the output or an Error and program pause will occur.

Screen 8 (Jump Command) allows the user to specify the type of jump command to issue at the end of the NC block. (Refer to Program Jumps on page 4-80 for a more detailed explanation on the functionality of each jump command).

Screen 8:

```
N006 TO POS STOP
→1.No Jump
 2.JN uncond
 3.JU subroutine
```

Sub-screens

```
N006 TO POS STOP
 1.No Jump
→2.JN uncond
 3.JU subroutine
```

```
N006 TO POS STOP
 Jump
JN= 007
```

```
N006 TO POS STOP
 2.JN uncond.
→3.JU subroutine
 4.JR reverse
```

```
N006 TO POS STOP
 Jump
JU= 007
```

```
N006 TO POS STOP
 3.JU subroutine
→4.JR reverse
 5.JS jump&stop
```

```
N006 TO POS STOP
 Jump
JR= 007
```

```
N006 TO POS STOP
 4.JR reverse
→5.JS jump&stop
 6.JC cond.
```

```
N006 TO POS STOP
 Jump
JS= 007
```

```
N006 TO POS STOP
 5.JS jump&stop
→6.JC cond.
 7.JReturn
```

```
N006 TO POS STOP
 Jump
JC= 007:011
```

Target NC Block   Cond Jump Inputs

```
N006 TO POS STOP
 5.JS jump&stop
 6.JC cond.
→7.JReturn
```

When the user has programmed all of the above options, the NC Block save key must be press to save the NC Program Block into memory and proceed to the next block.

Spindle Function

Spindle function allows the user to activate a spindle within a NC block. The spindle can be turn on (RPM) or positioned for some other function in proceeding NC blocks. Refer to Spindle Positioning Control (NC Code P) on page 4-76 for more information.

Select To Pos. Stop from the Primary Function selection screen to begin this NC program block.

Primary Function Selection Screen

```
N007  Function?
 5.Home Axis
 6.To Pos.Stop
→7.Spindle Func
```

Screen 1 and sub-screens are only displayed if a spindle axis has been configured in Process parameter P02 (Axis Configuration). If no spindle axis is configured, the CTA10-1 will display "Spindle Not Enable!" when this function is requested.

Screen 1:

```
N007 S FUNCTION
→1.No Spindle
 2.Spindle-RPM
 3.SpIndle-POS
```

Sub-screens

```
N007 S FUNCTION
 1.No Spindle
→2.Spindle-RPM
 3.SpIndle-POS
```

```
N007 S FUNCTION
 Spindle-RPM
S= 8100
```

```
N007 S FUNCTION
 1.No Spindle
 2.Spindle-RPM
→3.SpIndle-POS
```

```
N007 S FUNCTION
 Spindle-POS
P= 90 degrees
```

No Spindle: Select this option if no spindle movement is desired.

Spindle RPM: Enter the speed in rpm at which the spindle is to operate in this and subsequent NC Blocks, then press ENTER. The maximum spindle rpm range is +/-9999 rpm. However, your input range is limited (in both + and - directions) by the maximum rpm specified in the spindle axis parameter **SA1** (Max. Speed for DIAX01) or **AS08** (Max. Speed for DIAX02/03/04.) If the value of the mentioned Spindle axis parameter is reduced after your program is entered, the instructions will be executed, but the spindle speed will be limited by the new value, regardless of a higher speed entered in a program NC Block.

Spindle POS: Enter the position you want the spindle to orient. This must be a value between 0.1 - 359.9 degrees. Positions must be entered in degrees, with a resolution of 0.1 degree. This position is relative to the marker pulse on the spindle encoder. The position of the marker pulse is pre-defined as 0 degrees.

Screen 2 allows the user to program the Auxiliary Outputs. When the output is correctly acknowledged the program progresses to the next NC Block.

The outputs are programmed with the following states (conditions):

Auxiliary Output Definition:

M 0 1 2 1 1 1 1 1 1 0 0

0 - requires input to be always low

1 - requires input to be always high

2 - does not monitor the state of the input. I.e., if the input changes from 0 to 1, the TRANS 01-D will not issue a fault.

Screen 2:

```
N007  S  FUNCTION
   Aux.Function
  M=
```

Some of the Auxiliary outputs are acknowledgeable. This depends upon the selected I/O option in process parameter **P02**. Refer to Chapter 4, Process Parameters. The status of the corresponding input must match the status of the output or an Error and program pause will occur.

Screen 3 (Jump Command) allows the user to specify the type of jump command to issue at the end of the NC block. (Refer to Program Jumps on page 4-80 for a more detailed explanation on the functionality of each jump command).

Screen 3:

```
N007 S FUNCTION
→1.No Jump
 2.JN uncond
 3.JU subroutine
```

Sub-screens

```
N007 S FUNCTION
 1.No Jump
→2.JN uncond
 3.JU subroutine
```

```
N007 S FUNCTION
 Jump
JN= 008
```

```
N007 S FUNCTION
 1.No Jump
 2.JN uncond.
→3.JU subroutine
```

```
N007 S FUNCTION
 Jump
JU= 008
```

```
N007 S FUNCTION
→4.JR reverse
 5.JS jump&stop
 6.JC cond.
```

```
N007 S FUNCTION
 Jump
JR= 008
```

```
N007 S FUNCTION
 4.JR reverse
→5.JS jump&stop
 6.JC cond.
```

```
N007 S FUNCTION
 Jump
JS= 008
```

```
N007 S FUNCTION
 4.JR reverse
 5.JS jump&stop
→6.JC cond.
```

```
N007 S FUNCTION
 Jump
JC= 008:011
```

Target NC Block   Cond Jump Inputs

```
N007 S FUNCTION
 5.JS jump&stop
 6.JC cond.
→7.JReturn
```

When the user has programmed all of the above options, the NC Block save key must be press to save the NC Program Block into memory and proceed to the next block.

AF Switching (NC Code G20 & G21)

AF switching is a function that allows an axis to be Disabled (G21) and Enabled (G20) for a process within a program. Once an axis is disabled, the user can no longer program a NC block with that axis until it is enabled once again. Refer to Axis Enable and Disable (G20, G21) on page 4-48 for more information.

Select AF Switching from the Primary Function selection screen to begin this NC program block.

Primary Function Selection Screen

```
N008  Function?
 6.To Pos.Stop
 7.Spindle Func
→8.AF Switching
```

Screen 1 allows the user to select whether to **Disable** (G21) or **Enable** (G20) an axis.

Screen 1:

```
N008 AF SWITCH
→1.Enable
 2.Disable
```

Screen 2 allows the user to select which axis will be disable or enable by pressing its corresponding number on the CTA10-1 keypad or scroll using the arrow keys and press ENTER.

Note: Only configured SERVO axes in process parameter P02 can be selected for AF Switching. A configured spindle axis **cannot** be selected for AF Switching.

Screen 2:

```
N008 AF SWITCH
→1.X-Axis
 2.Y-Axis
 3.Z-Axis
```

Screen 3 allows the user to program the Auxiliary Outputs. When the output is correctly acknowledged the program progresses to the next NC Block.

The outputs are programmed with the following states (conditions):

Auxiliary Output Definition:

M 0 1 2 1 1 1 1 1 1 0 0

0 - requires input to be always low

1 - requires input to be always high

2 - does not monitor the state of the input. I.e., if the input changes from 0 to 1, the TRANS 01-D will not issue a fault.

Screen 3:

```
N008 AF SWITCH
  Aux.Function
 M=
```

Some of the Auxiliary outputs are acknowledgeable (This depends upon the selected I/O option in process parameter **P02**. Refer to Chapter 4, Process Parameters.) The status of the corresponding input must match the status of the output or an Error and program pause will occur.

Screen 4 (Jump Command) allows the user to specify the type of jump command to issue at the end of the NC block. (Refer to Program Jumps on page 4-80 for a more detailed explanation on the functionality of each jump command).

Screen 4:

```
N008 AF SWITCH
→1.No Jump
 2.JN uncond
 3.JU subroutine
```

Sub-screens

```
N008 AF SWITCH
 1.No Jump
→2.JN uncond
 3.JU subroutine
```

```
N008 AF SWITCH
 Jump
JN= 009
```

```
N008 AF SWITCH
 1.No Jump
 2.JN uncond.
→3.JU subroutine
```

```
N008 AF SWITCH
 Jump
JU= 009
```

```
N008 AF SWITCH
→4.JR reverse
 5.JS jump&stop
 6.JC cond.
```

```
N008 AF SWITCH
 Jump
JR= 009
```

```
N008 AF SWITCH
 4.JR reverse
→5.JS jump&stop
 6.JC cond.
```

```
N008 AF SWITCH
 Jump
JS= 009
```

```
N008 AF SWITCH
 4.JR reverse
 5.JS jump&stop
→6.JC cond.
```

```
N008 AF SWITCH
 Jump
JC= 009:101
```

Target NC Block

Cond Jump Inputs

```
N008 AF SWITCH
 5.JS jump&stop
 6.JC cond.
→7.JReturn
```

When the user has programmed all of the above options, the NC Block save key must be press to save the NC Program Block into memory and proceed to the next block.

Tool Correction

This menu selection allows programming a tool correction code in a block without axis or spindle motion commands. Auxiliary Function and/or Jump commands can be included in the block if desired.

Select Tool Correction from the Primary Function selection screen to begin this NC program block.

Primary Function Selection Screen

```
N009  Function?
 8.AF Switching
→9.Tool Corr.
 10.No Operation
```

Screen 1 (Tool Correction) allows for activation of pre-programmed tool corrections to be entered for compensations in tool wear. The value entered in this screen represents an address within the Tool Correction register table not contained within this program block. Refer to Tool Corrections, page 4-13 and 4-71 for a complete description.

Screen 1:

```
N009 Tool Corr.
 Tool Correction
 T=
```

Screen 2 allows the user to program the Auxiliary Outputs. When the output is correctly acknowledged the program progresses to the next NC Block.

The outputs are programmed with the following states (conditions):

Auxiliary Output Definition:

M 0 1 2 1 1 1 1 1 1 0 0

0 - requires input to be always low

1 - requires input to be always high

2 - does not monitor the state of the input. I.e., if the input changes from 0 to 1, the TRANS 01-D will not issue a fault.

Screen 2:

```
N009 Tool Corr.
  Aux.Function
 M=
```

Some of the Auxiliary outputs are acknowledgeable. This depends upon the selected I/O option in process parameter **P02**. Refer to Chapter 4, Process Parameters. The status of the corresponding input must match the status of the output or an Error and program pause will occur.

Screen 3 (Jump Command) allows the user to specify the type of jump command to issue at the end of the NC block. (Refer to Program Jumps on page 4-80 for a more detailed explanation on the functionality of each jump command).

Screen 3:

```
N009 Tool Corr.
→1.No Jump
 2.JN uncond
 3.JU subroutine
```

Sub-screens

```
N009 Tool Corr.
 1.No Jump
→2.JN uncond
 3.JU subroutine
```

```
N009 Tool Corr.
     Jump
JN= 007
```

```
N009 Tool Corr.
 2.JN uncond.
→3.JU subroutine
 4.JR reverse
```

```
N009 Tool Corr.
     Jump
JU= 007
```

```
N009 Tool Corr.
 3.JU subroutine
→4.JR reverse
 5.JS jump&stop
```

```
N009 Tool Corr.
     Jump
JR= 007
```

```
N009 Tool Corr.
 4.JR reverse
→5.JS jump&stop
 6.JC cond.
```

```
N009 Tool Corr.
     Jump
JS= 007
```

```
N009 Tool Corr.
 5.JS jump&stop
→6.JC cond.
 7.JReturn
```

```
N009 Tool Corr.
     Jump
JC= 007:011
```

Target NC Block (007) — Cond Jump Inputs (011)

```
N009 Tool Corr.
 5.JS jump&stop
 6.JC cond.
→7.JReturn
```

When the user has programmed all of the above options, the NC Block save key must be press to save the NC Program Block into memory and proceed to the next block.

No Operation

The No Operation function is used to activate a NC block that will be left blank intentionally. This function can be used to replace a previously programmed block that was part of a program flow. If an NC Block if not programmed with a No Operation function and is part of a program flow, the TRANS 01-D will issue an error.

Select No Operation from the Primary Function selection screen to begin this NC program block.

Primary Function Selection Screen

```
N010  Function?
 8.AF Switching
 9.Tool Corr.
→10.No Operation
```

Once No Operation is selected from the primary function selection screen, Screen 1 will be displayed.

Screen 1:

```
N010 BLOCK FOR
  NO OPERATION
```

4.6 Recommended Programming Styles with an Example

There are two primary modes in which the TRANS 01-D can successfully run its stored NC part program and still be controlled by an external PLC type device, these modes are *Manual* and *Automatic*.

- **Automatic** (or Auto) mode is achieved by bringing the TRANS 01-D 'Auto' input high (e.g., DEA 4 pin 2 high). The most left column of the CTA10-1 should have "AUTO" running vertically from top to bottom of the screen.

```
A N000 X-Axis
U Act=  0.00000
T Dev=  0.00000
O Vel=  0.00000
```

- **Manual** mode is achieved by the combination of

The TRANS 01-D NOT having its 'Auto' input high (e.g., IBS object #5FB1 Bit 3 low)

and

The TRANS 01-D has been set to 'Single Cycle' mode, number 4 ***Single Cycle*** within the Menu key, and the most left column of the CTA10-1 should have "1CYC" running vertically from top to bottom of the screen.

```
1 N000 X-Axis
C Act=  0.00000
Y Dev=  0.00000
C Vel=  0.00000
```

Automatic Mode

The sample NC part program figure 1 on page 4-47 will be referred to when explaining the operation of the TRANS 01-D in Automatic mode. The interface selected is a DEA 4 & 5 configuration. This NC part program was written for a three axes servo system with each axis motor containing an <u>Absolute Encoder</u> that can be referenced to a positive stop. The program demonstrates use of reverse vectors to recover from behind the workpiece. It also shows use of conditional jumps for selection of one of three different programs, a move to tool change position, and homing to positive stop.

To run NC part programming blocks N195 to N198, the PLC must have "Auto", "Enable" and "Rev" high and then bring "Home Request" high at least 200msec afterwards.

- The TRANS 01-D is in "Auto" mode at N000 with the "Ready", "At Home" and "No Fault" outputs high.
- The PLC sets the correct Conditional Jumps at the input to the DEA 4 & 5 cards. In this example we select Conditional Jump 3.
- The PLC provides the "Cycle Start" signal at least 50msec after setting the Conditional Jumps.
- The program jumps to N010, sets the Reverse Vector to N120, and begins to execute the motion programmed in N011 & N012.

If at any stage during the execution of N011 & N012 a “Home Request” input is received by the TRANS 01-D it will immediately jump to N120 and begin execution of the absolute positional move to zero of the Y & Z axis at a feedrate of 100 units.

- Once the TRANS 01-D has completed N012, the Reverse Vector is set to N130. The TRANS 01-D continues to execute N013.

  If at any stage during the execution of N013 a “Home Request” input is received by the TRANS 01-D, it will immediately jump to N130 and begin execution of the absolute positional move to zero of the X then Y & Z axes at a feedrate of 200 units.

- Once the TRANS 01-D has completed N013, the Reverse Vector is set to N140. The TRANS 01-D continues to execute N014.

  If at any stage during the execution of N014, a “Home Request” input is received by the TRANS 01-D it will immediately jump to N140 and begin execution of the absolute positional move forward to the advanced position of the Y & Z axes at a feedrate of 300 units. After reaching the advanced position, it will jump to N130 and begin execution of the absolute positional move to zero of the X then Y & Z axes at a feedrate of 200 units.

- When N014 has been successfully completed, the Reverse Vector is set to the block number (N015) immediately after the block (N014) that contains the JR000 marking to end of the forward profile. The TRANS 01-D continues executing the Reverse Vector program from N015 through N017.

  Any “Home Request” input during these blocks (N015 to N017) would effectively be ignored as the TRANS 01-D considers itself to be executing the current Reverse Vector. It does not back out to the home position – instead it moves forward on the normal return profile until it reaches the home position.

- Once the moves to the returned position are completed, JN180 causes a jump to an exit routine that sets the Reverse Vector to N195 and then does “JS000” to jump and stop at N000. This sets the program pointer to N000 and leaves the Reverse Vector at N195 as set in block N180.

Note: JS000 does not set the Reverse Vector to N195. Without the “JR195”, the Reverse Vector would still be set to the block immediately following the block that contained the JR000. Then, after completing block N017, if the “Home Request” were given to the TRANS 01-D, the TRANS 01-D would begin to execute block N015. In cases where different parts of the program are selected and executed in series without going back to the returned position, it might be desirable to retain a reverse vector for a special path to recover from the current position and not set it back to the normal homing routine. It is always up to the program to set the Reverse Vector.

Manual Mode

The NC part program listed below (Fig 1) will be referred to when explaining the operation of the TRANS 01-D in Manual mode. The interface selected is a DEA 4 & 5 configuration. This NC part program was written for a three axes servo system with each axis motor containing an Absolute Encoder that can be referenced to a positive stop.

The only way the program can run NC part programming blocks N195 to N198 is for the PLC to have input “Auto” low with “Enable” and “Home Request” high and at least 200msec afterwards to bring “Reverse” high.

Manual mode is controlled primarily by the “Forward” and “Reverse” inputs of the TRANS 01-D. The “Reverse program” in manual mode refers to the NC part programming blocks that appear after the NC block that contains the “JR000”. Where the “JR000” is programmed is at the discretion of the NC part programmer but it is generally programmed when the machining of the part is complete and the subsequent NC part programming blocks contain motion to return all axis to zero reference.

Note: To have the “Ready” output high while in Manual, the System Options parameter P06 “Manual Mode Ready” must be set to “Enabled”. The following example assumes that system parameter setting.

- The TRANS 01-D is in “1CYC” mode at N000 with the “Ready”, “At Home” and “No Fault” outputs high.
- The PLC sets the correct Conditional Jumps at the inputs to the DEA 4 & 5 cards. In this example we select Conditional Jump 1.
- The PLC provides the “Forward” signal at least 20msec after setting the Conditional Jumps.
- The program jumps to N020 - sets the Reverse Vector to N120 – and begins to execute the motion programmed in N021 & N022.

  If at any stage during the execution of N021 & N022, the “Forward” input is brought low and the “Reverse” input is brought high to the TRANS 01-D, it will immediately jump to N120 and begin execution of the absolute positional move to zero of the Y & Z axis at a feedrate of 100 units.
- Once the TRANS 01-D has completed N022, the Reverse Vector is set to N130. The TRANS 01-D continues to execute N023.

  If at any stage during the execution of N023, the “Forward” input is brought low and the “Reverse” input is brought high to the TRANS 01-D, it will immediately jump to N130 and begin execution of the absolute positional move to zero of the X then Y axis at a feedrate of 200 units.
- Once the TRANS 01-D has completed N023 the Reverse Vector is now set to N142. The TRANS 01-D continues to execute N024.

  If at any stage during the execution of N024, the “Forward” input is brought low and the “Reverse” input is brought high to the TRANS 01-D, it will immediately jump to N142 and begin execution of the absolute positional move forward to the advanced position of the Y axis at a feedrate of 100 units. After reaching the advanced position, it will jump to N130 and begin execution of the absolute positional move to zero of the X then Y & Z axes at a feedrate of 200 units.
- When N024 has been successfully completed, the Reverse Vector is set to the block number (N025) immediately after the block (N024) that contains the JR000 marking to end of the forward profile. Holding of the “Forward” input high will no longer allow the continued execution of

the block N025. The “Forward” input must be brought low and the “Reverse” input high and the Reverse program from N025 through N027 will now be run.

- Once the moves to the returned position are completed, JN180 causes a jump to an exit routine that sets the Reverse Vector to N195 and then does “JS000” to jump and stop at N000. This sets the program pointer to N000 and leaves the Reverse Vector at N195 as set in block N180.

Note: JS000 does not set the Reverse Vector to N195. Without the “JR195”, the Reverse Vector would still be set to the block immediately following the block that contained the JR000. Then, after completing the “JS000” block, if the “Reverse” were given to the TRANS 01-D, the TRANS 01-D would begin to execute block N025. In cases where different parts of the program are selected and executed in series without going back to the returned position, it might be desirable to retain a reverse vector for a special path to recover from the current position and not set it back to the normal homing routine. It is always up to the program to set the Reverse Vector.

```
N000 JC010:00100                                          // Conditional jump to Two heads cutting
N001 JC020:00001                                          // Conditional jump to Y head cutting
N002 JC030:00010                                          // Conditional jump to Z head cutting
N003 JN180
                                                          // Jump to Exit
…..Two heads cutting ….
N010 JR120                                                // Sets reverse vector to N120
N011 G00 G90 G62 Y3.000 Z3.000 M22222222211               // Rapid heads to part
N012 G01 G90 G61 Y11.000 Z11.000 F112.0 M11222222222 JR130 // Feed heads to cut left walls
N013 G01 G90 G61 X29.405 F78.0 M22220022222 JR140         // Feed main slide to cut back wall
N014 G01 G90 G61 Y5.750 Z5.750 F112.0 M22110022222 JR000  // Cut right walls, end forward profile
N015 M11000000000                                         // Hydraulic acknowledgments
N016 G00 G90 G61 Y0.000 Z0.000                            // Rapid Return heads to home position
N017 G00 G90 G61 X0.000 M00000000000 JN180                // Rapid Return main slide to home position, Jump to Exit

…..Y axis head cutting…..
N020 JR120                                                // Sets reverse vector to N120
N021 G00 G90 G62 Y3                                       // Rapid head to part
N022 G01 G90 G61 Y11.000 F78.0 M12222222222 JR130         // Feed head & cut left wall
N023 G01 G90 G61 X29.405 F78.0 M22220222222 JR142         // Move main slide to cut back wall
N024 G01 G90 G61 Y5.750 F78.0 M22120222222 JR000          // Cut right wall, end forward profile
N025 M20000000000                                         // Hydraulic acknowledgments
N026 G00 G90 G61 Y0.000                                   // Rapid Return Y axis head to home position
N027 G00 G90 G61 X0.000 M00000000000 JN180                // Rapid Return main slide to home position, Jump to Exit

…… Z axis head cutting …..
N030 JR120                                                // Sets reverse vector to N120
N031 G00 G90 G62 Z3.00 M22222122222                       // Rapid head to part
N032 G01 G90 G61 Z11.000 F78.0 M21222222222 JR130         // Feed head and cut left wall
N033 G01 G90 G61 X29.405 F78.0 M22222022222 JR144         // Move main slide to cut back wall
N034 G01 G90 G61 Z5.750 F78.0 M20212022222 JR000          // Cut right wall, end forward profile
N035 M02000000000                                         // Hydraulic acknowledgments
N036 G00 G90 G61 Z0.000                                   // Return Z axis head to home position
N037 G00 G90 G61 X0.000 M00000000000 JN180                // Return main slide to home position, Jump to Exit

//   ****************** Reverse Program used before left wall cut finished*********************
N120 G01 G90 G61 Y0.000 Z0.000 F100.0 M00000000000        // Return heads to home position
N121 G00 G90 G61 X0.000 JN180                             // Return main slide to home position, Jump to Exit

//   ****************** Reverse Program used before back wall cut finished*********************
N130 G01 G90 G61 X0.000 F200.0 M00000000000               // Return main slide to home position
N131 G01 G90 G61 Y0.000 Z0.000 F200.0 JN180               // Return heads to home position, Jump to Exit

//   ****************** Reverse Program used before right wall cut finished*********************
N140 G01 G90 G61 Y11.000 Z11.000 F300.0 M00000000000 JN130 // Move heads to forward position, Jump to back wall recovery

//   ****************** Reverse Program used before Y-axis has back wall cut finished*************
N142 G01 G90 G61 Y11.000 F100.0 M00000000000 JN130        // Move Y head to forward position, Jump to back wall recovery

//   ****************** Reverse Program used before Z-axis has back wall cut finished*************
N144 G01 G90 G61 Z11.000 F100.0 M00000000000 JN130        // Move Z head to forward position, Jump to back wall recovery

//   ************************** Jump on Event Routine ************************************
N170 M00000000011 JN180                                   // Jump on Event routine

//   *************************** Exit Routine (all paths end here) *****************************
N180 JR195                                                // Set Reverse Vector to block N195
N181 JS000                                                // Jump and Stop to block N000

//   *************************** Tool Change Routine ****************************************
N185 G01 G90 G61 Y-7.0 Z-7.0 F100.0                       // Absolute Y & Z axes move to Tool Change position
N186 G01 G90 G61 X0 F100 M22222212222 JN180               // Absolute X axis move to Tool Change position, set tool change auxiliary, Jump to
                                                          Exit

//   ************************ Home to Positive Stop Routine *********************************
N190 G69 G90 Y0.000 F30.0                                 // Home to Positive Stop for Y axis
N191 G69 G90 Z0.000 F30.0                                 // Home to Positive Stop for Z axis
N192 G69 G90 X0.000 F30.0 JN180                           // Home to Positive Stop for X axis, Jump to Exit

//   ************************ Homing Routine ********************************************
N195 M00000000000
N196 JC190:11000                                          // Conditional jump to Home to Positive Stop
N197 JC185:01000                                          // Conditional jump to Tool Change
N198 G01 G90 G61 Y0.000 Z0.000 F135                       // Absolute Y & Z axes move to zero
N199 G01 G90 G61 X0.000 F135 JN180                        // Absolute X axis moves to zero, Jump to Exit
```

Fig. 4-1: Programming example

4.7 TRANS 01-D NC Code Descriptions

In this section, the NC codes, as used by the TRANS 01-D, are described in detail along with illustration to help explain the function. The following table contains the functions that are available in each NC Block, depending on the selected Process, Axis and Spindle parameters.

NC CODE	FUNCTION	Refer to Page
G00	Rapid Feed Positioning	4-55
G01	Programmed Feedrate Positioning	4-55
G04	Dwell time	4-71
G08	Adaptive Depth	4-58
G20	Re-enable Axis	4-48
G21	Disable Axis	4-48
G69	Home to a Positive Stop	4-52
G74	Homing	4-51
G75	Enable Feed to a Positive stop	4-57
G76	Disable Feed to a Positive Stop	4-57
G90	Position command - Absolute (Destination)	4-55
G91	Position command - Incremental (Distance)	4-55
G61	With Lag Finishing	4-56
G62	Without Lag Finishing	4-56
G36	Rotary Positioning - Shortest Path	4-65
G37	Rotary Positioning - Positive Direction Only	4-65
G38	Rotary Positioning - Negative Direction Only	4-65
X, Y, Z	Axis designation	
F	Feedrate or Dwell Time	4-71
T	Tool Correction register number to be used	4-71
S	SERCOS spindle RPM speed (Must be enabled in Parameters)	4-76
P	Spindle position	4-76
M	Auxiliary functions	4-79
Jx	Program jumps: JN -- Unconditional jump JU -- Jump to subroutine JR -- Reverse vector programming JS -- Jump and stop JC -- Conditional jump JReturn -- Return from subroutine	4-80 4-80 4-82 4-81 4-81 4-80 4-83

Table 4-2: Available Program Functions

Axis Enable and Disable (G20, G21)

This functionality allows the Indramat drive to continue monitoring the actual position of the motor encoder even though there is no holding torque applied from the drive. This is commonly utilized with rotary axis applications where hydraulic clamping mechanisms are used to maintain the stability of high mass drive-trains rather than risk motor overload during cutting.

Because there is no torque applied to the motor during G21 (readout from drive will be “Ab”) only dwell times, block jumps and Input / Output handling should be used while the drive is in this state.

The Axis Disable feature needs to be selected in Aa16 of whichever drive is to be programmed with the G21 / G20 command, otherwise the error “785: Axis NOT configured for AF switching ” will be generated.

While a particular axis is disabled, it is possible to execute programmed moves of other axes that are not disabled. If a program block attempts to move a disabled axis, an error occurs that says “810 X axis is not ready/enabled”, “811 Y axis is not ready/enabled”, or “812 Z axis is not ready/enabled”.

With TRANS 01-D firmware version 06VRS release 06V49 and earlier, while an axis is disabled with G21, it is not possible to jog any axis. An attempt to jog an axis results in error “System: 202 Drive n is not ready” (where n is 1, 2, or 3 for axis X, Y, or Z indicating which axis is disabled). With later releases it is possible to jog an enabled axis while another axis is disabled.

Program Example:

N001 G21 Z0

N002 M10000000000

N003 G20 Z0

N004 G91 G61 Z10 F10 M00011100000 ....

Explanation:

N001 G21 (Axis disable) when executed will drop the selected Indramat servo drive, Z-axis in the above example, into its **‘AB’** state. This means that this drive is now disabled, it still has control and bus voltage, but will not exert any torque on the motor shaft. The drive system is still monitoring any change of the motor position through the motor encoder. To specify the axis, use Z0, Y0, or X0.

N002 This block signifies whatever is to occur while the servo-drive is in its disabled state. This particular block is waiting for an Acknowledgment Output to be acknowledged before proceeding to the next block. This acknowledgment could be a signal from a mechanism confirming that a physical shot-pin is in place to stabilize a rotary table. These pins may not be aligned up exactly with their respective slots but they will not encounter any opposing torque from the drive system as they force themselves into their slots.

N003 This block return the drive to its **‘AH’** enabled state and normal motion can now be commanded of the drive. The drive knows exactly where it is after the N002 block and will not try to make up any following error from the N001 block.

N004 The NC part program continues.

Basic Homing Program

When incremental feedbacks are used, a homing program for travel to the reference position is required at NC Block 195. It must conform to the following requirements:

1. No instruction for travel to a particular position is permitted if there is no prior instruction for homing.
2. The program must always contain a Homing instruction (Block 195 is Default NC Block).
3. The program must always be terminated with a Jump To Block 000 And Stop instruction. The simplest such program in NC Block 195 could be Homing at a feedrate of 100 UPM (Units per Minute) with a Jump to Block 000 and Stop.
4. Only one axis can be programmed in a G74 block

Note: Absolute feedbacks, when used in TRANS 01-D systems, do not require homing, but any profile used to return the axis to its home position should begin in Block 195.

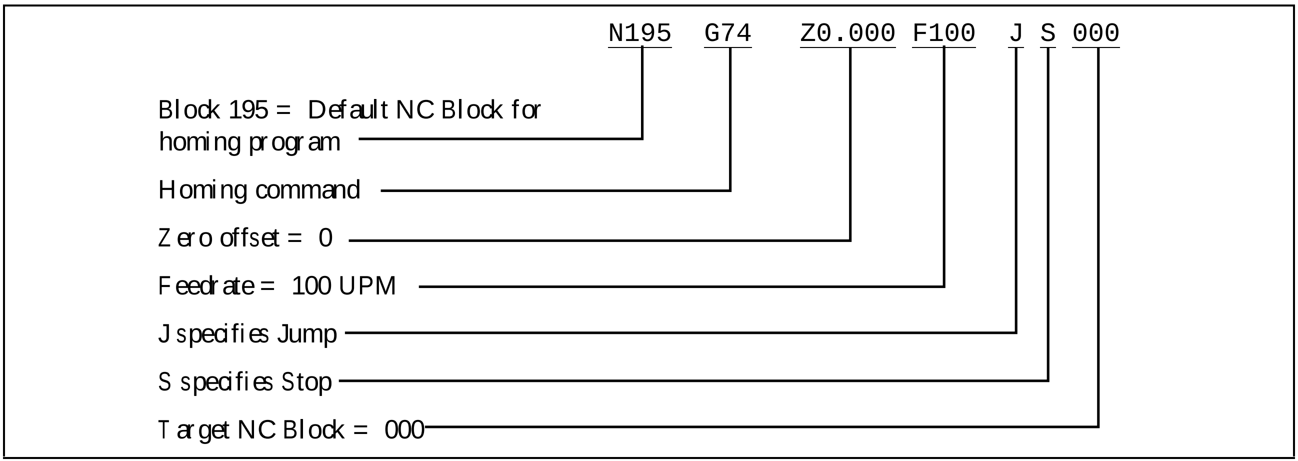


Fig. 4-2: Simple homing instruction

The homing program must be designed so that safe retraction is possible under any condition, including power shutdown. To insure this, the TRANS 01-D has been provided with "reverse vectors" which will determine the NC Block number to which the program will jump if a Homing (Reverse) command is issued in Automatic or Manual modes.

Note: With TRANS 01-D version 05 but with TRANS 01-D version 06 a JS000 does ***not*** reset the reverse vector to N195 ***but*** leaves the current reverse vector active.

The reverse vector number is retained even if a power failure occurs.

As described in the section titled, "Auxiliary Functions (NC Code M", auxiliary outputs can be issued at various points in the program and the TRANS 01-D waits for an acknowledgment for each output turned on or off before it executes the next NC Block. The one exception to this is that a jump to a reverse program is performed even if the acknowledgments do not match their associated outputs, provided that the first NC Block of that program performs only auxiliary output functions. (This is useful for an emergency return or upon recovery from a power failure.)

This first NC Block in the reverse program (usually 195) should force the auxiliary outputs into a state where they match their acknowledgments. The next NC Block then will usually be a homing command. This should

only be performed if it is indeed safe to force auxiliary outputs off and move.

Homing and Zero Offset (NC Code G74 & G69)

G74 Standard Homing

When G74 Homing is selected during dialog programming, the CTA10-1 will display ZERO OFFSET? Note that a reference value is entered as a system parameter (Ax13). This reference value is used to establish the machine reference point as some point other than Home, such as the center point of the slide. If all references to the part are to be programmed with respect to this machine reference point, a zero offset value of 0 must be entered.

However, if the measurements in the program are to be programmed with respect to some other reference, such as the face of the workpiece, the distance from the machine reference point to the workpiece reference point is entered as the zero offset, providing a new reference point which is offset some specified distance from the machine reference point.

The value entered as the zero offset is added to the reference position after homing has occurred. Thus, the zero offset can be used by the programmer in order to program the measurements in a machining program with respect to one of the surfaces of the work piece.

In order to assure correct measuring references, programs which use zero offset referenced measurements must be started with a homing instruction which sets the corresponding zero offset.

Note that the control is at Home when the slide is at the position where the first marker pulse (zero pulse) occurs after closure of the Home Limit switch, and that no movement of the slide will occur when programming a zero offset.

The zero offset provides the flexibility to change the reference point whenever a different part is handled on the TRANS 01-D transfer line, or to correct differences between actual and designed Home position.

Note: For information specific to Homing a rotary axis, refer to the Rotary Motion Control section.

G69 Home to a Positive Stop

Home to Positive stop is a feature used for convenience to initialize the position of an Indramat multi-turn absolute feedback. This is a requirement encountered in the commissioning of machines using absolute feedback devices. When first installed, or whenever the feedback-to-machine orientation is disrupted, the feedback will report a position that is not relevant to the actual machine state. A method must be available to orient the machine to a known position, then load the absolute feedback with that value. SERCOS equipped Indramat drives contain a feature that allows this via the setting of a SERCOS procedure. The SERCOS Ident used is P-0-0012. This function is also available in Indramat's Visual TRANS software, in easy to use graphic screens. G69 offers an alternative method to perform this orientation. It achieves this by moving the slide in the following sequence:

1. The axis moves in a parameter-dictated direction until a stalled-motor condition is detected; that is, a positive stop is found. The length of this move is limited to the total travel distance as defined in the travel limit parameters (Aa06), plus 10%. If the stop is not found in this distance, an error results.
2. The axis reverses direction and moves away from the stop a distance equal to the value programmed in parameter Aa22 ("Home to Stop Distance").
3. When the axis has reached the above position, the absolute encoder value is reset to the value stored in the Reference Position parameter (Aa13).

Note: G69 is intended for use only during initial machine commissioning, or when alterations have been made to the drive train that destroy the relationship between the absolute encoder and the actual machine position. This could occur for example during removal of the motor, gearbox, or ballscrew. A move to a positive stop is not always a repeatable function. Changes in drive train temperature, friction, or compliance, as well as contamination in the area of the stop (such as cutting chips), can cause the relationship between actual slide position and the absolute encoder setting to be different between two home to positive stops. For this reason, axis position should be accurately checked after the operation.

Note: G69 should not be programmed as a machine operator accessible function. It should only be accessible to maintenance personnel. During machine commissioning, it is advisable to disable the function via parameter Aa12 after the absolute feedback is set, to prevent unintentional repeats of the function afterwards. An alternative to this function is to use the absolute encoder initialization routine available in Visual TRANS software.

Note: Do not program a G69 function in the default block for homing (N195). This will cause the TRANS to execute the procedure every time the TRANS-01 is commanded to return, resulting in possible position errors. See warnings above.

Associated Parameters

Aa11: Directions	The homing direction parameter will determine the direction the axis will move when first searching for the positive stop. A '0' programmed in this parameter will cause the axis to search in the "plus" direction. A '1' will cause the axis to search in the "minus" direction.
Aa12: Homing Reference	This parameter indicates the method used to determine the initial home position. Home to a Positive Stop is enabled here, by selecting option '4'.
Aa13: Reference Position	This parameter contains the absolute value that should be used for home position when it is found. The actual position register is loaded with this value at the end of a G69 function.
Aa20: Positive Stop Feedrate	Aa20 contains the maximum feedrate that can be programmed when executing any positive stop functions. This also applies to G69, Home to Positive Stop.
Aa21: Positive Stop Torque %	This two-part parameter indicates the percentage of available torque the motor should be limited to when (1) Approaching the positive stop ("To the Stop"), and (2) once the positive stop is detected ("At the Stop"). These values are used for both Move to Positive Stop (G75) and Home to Positive Stop (G69).
Aa22: Home to Stop Distance	During a G69 function, the TRANS 01-D uses this parameter to determine the distance the axis should move away from the positive stop, before stopping and setting reference position. The value is non-signed, as the direction is determined by the inverse of the state of parameter Aa11.

Programming G69 is programmed similar to any move command.

Required block contents:

Function:	G69 is entered into the block as the block function.
Axis Word (X, Y, or Z):	The block must contain the axis-word for the desired axis. The axis word must have a value associated with it equal to zero (example: "X0"). Zero offsets, such as those available with G74, are not available with G69. Zero Offsets are used to temporarily change axis offsets, as an aid to simplify part programming for multiple parts. G69 is intended for machine commissioning and repair only, and therefore should not be used to temporarily change axis co-ordinates. Only one axis is allowed per G69 operation.
Feedrate (F):	It is suggested that a feedrate always accompany a G69 function in a block for clarity and safety. The feedrate entered must be less than or equal to the value entered in Axis Parameter Aa20 ("Maximum Speed to Positive Stop"), or an error will result during execution. If no feedrate value is entered, the TRANS 01-D will default to the value in Aa20 (max. speed to positive stop).
Lag Finishing:	G69 always operates with G61 ("With Lag Finishing"). An error will result if an attempt is made to execute a G69 function with G62 ("Without Lag Finishing") active. G62 is a modal value, however, it is recommended that G61 always accompany a G69 move for clarity and certainty.

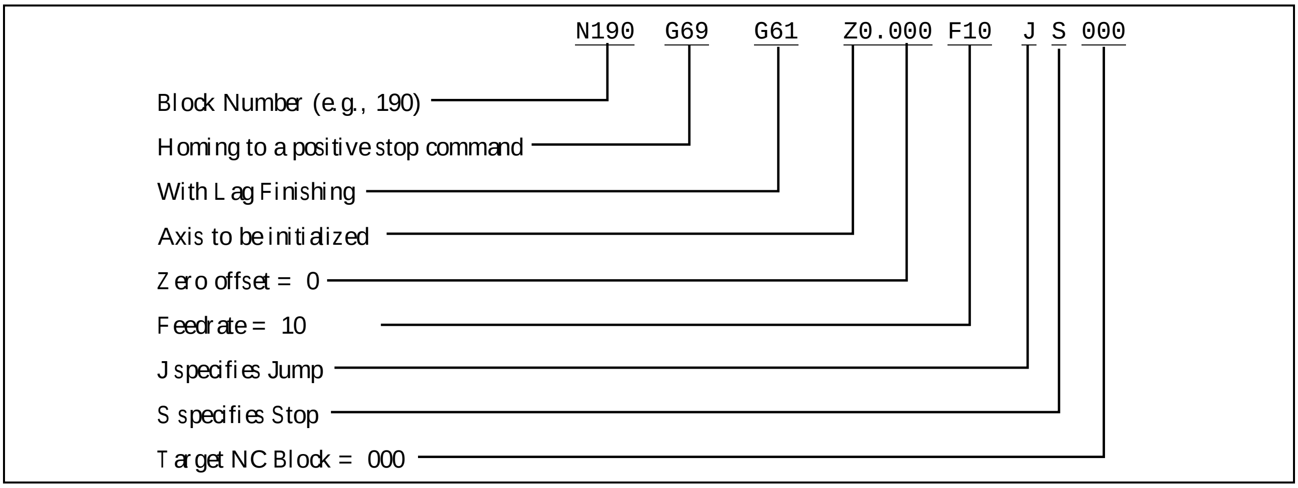


Fig. 4-3: Example Program Block

Operation

Using the previous example (N190 G69 G61 Z0 F10 JS000), with the following parameter conditions:

- Aa06: Overtravel Limits: = +20.000 and -0.400
- Aa11: Directions - Homing = 1 (Find stop in Negative Direction)
- Aa14: Reference Position = 4.000
- Aa22: Home to Stop Distance = 0.500

The motion profile would be as follows:

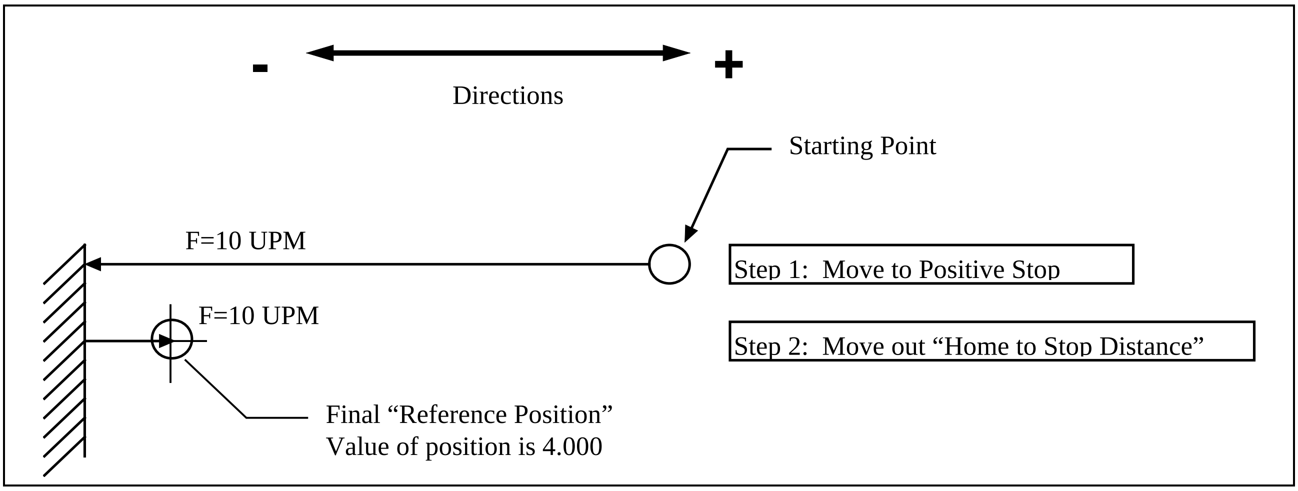


Fig. 4-4: Example Motion Profile

Note: Step 1 will attempt a move of 22.44. ([+20 - -0.4]*1.10). If the positive stop is not found in this range, a “Positive Stop Missing” error will result.

Note: Any subsequent G74 (homing) commands would move to the position defined here as “reference position”. Any Zero offset value in them would be added to the value of the reference position parameter after reaching this point, and its value would change to that result.

Positioning (NC Code G00, G01, G90 & G91)

G00 and G01 specify that a positioning move will be executed in this program NC Block. G00 specifies the speed to use for the commanded move will be at the Rapid Speed entered into the axis parameter. In this case, a Feedrate is not required in this NC Block. G01 specifies a positional move, but the programmer is prompted to enter a Feedrate value to be used for this move. If the programmer does not enter a Feedrate in this NC Block, it will be executed using the last feedrate value used for a positional move.

Two types of positioning can be selected in the system, absolute (G90) and incremental (G91).

Note: For information specific to Positioning a rotary axis, refer to the Rotary Motion Control section.

In absolute positioning (G90), all movements of the slide are made to some absolute distance from the machine reference position, which will either be Home or some offset position from Home. Thus, if the slide is at +2 inches from Home, a command to travel to +3 inches results in a one inch feed in the positive direction.

In incremental positioning (G91), all movements of the slide are made in the commanded direction to the distance specified, starting from the current position of the slide. Thus, if the slide is at +2 inches from Home, a command to travel +3 inches incrementally results in the slide positioned at +5 inches from Home.

Program example:

N001 G01 G90 G61 Z10 F20 M11122211122

N002 G00 G90 G61 X10 M22211122211

N003 G00 G91 G61 X20 M00022200022

N004 G01 G90 G61 X0 Z0 F20 M11111111111

Explanation:

N001 Absolute move with lag to Z10 at a feedrate of 20 and Aux 1,2,3,7,8,9 are turned on

N002 Rapid absolute move with lag to X=10 and Aux. 4,5,6,10,11 are turned on

N003 Rapid absolute move with lag to X=20 and Aux. 1,2,3,7,8,9 are turned off

N004 Absolute interpolated move with lag of X and Z to 0 with a path feedrate of 20 and Aux. 1,2,3,4,5,6,7,8,9,10,11 are turned on.

With / Without Lag During Positioning (G61 & G62)

When a position command is issued, the servomotor moves the axis in response to that command. There will always be some finite lag time between the time the command is issued and the time the servomotor brings the axis into position. It is important to note that, in a program NC Block, the TRANS 01-D does the positioning first, then performs any miscellaneous functions such as jumps or turning auxiliary functions on or off when it finishes the movement.

When programming your positioning commands, you will be required to respond to the "With/Without Lag?" display.

With Lag Finishing (**G61**) specifies that the axis must be in position before any miscellaneous functions remaining in the NC Block are executed or before the next NC Block is executed. This would be required at full depth, for example. It is important to note that this is also required where you have programmed miscellaneous functions, such as auxiliary outputs (see the section titled "Auxiliary Functions (NC Code M" for more information) which are to turn on only when the axis is in position.

Without Lag Finishing (**G62**) specifies that the velocity profile will be contoured from one NC Block's feedrate to the next NC Block's feedrate to avoid a stoppage of motion between NC Blocks. The position programmed in a G62 NC Block will be the position at which the axis has reached the next NC Block's feedrate. The move is considered to be finished once the axis is accelerating/decelerating into the subsequent feedrate, but prior to the time the position is actually reached. Thus, any auxiliary functions in this NC Block may be turned on while the axis is still in motion. Therefore, With Lag Finishing may not be necessary to your positioning operation, but you may need to select it to insure that auxiliary functions are not turned on too soon.

Note: When programming G62 "without lag" moves, a total of nine (9) NC program blocks can be used to complete one motion profile. However, the motion profile must end with a G61 "with lag" NC block included as one of the nine NC blocks.

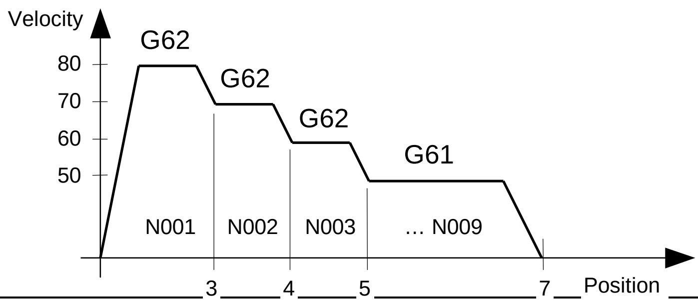
Example: **N001 G01 G90 G62 X3 F80**

N002 G01 G90 G62 X4 F70

N003 G01 G90 G62 X5 F60

……

N009 G01 G90 G61 X7 F50



Enable/Disable Feed To A Positive Stop (G75 & G76)

This function may be used when it is necessary to position the slide against a positive mechanical stop. The slide will move at the feedrate programmed in this block. The available torque of the motor will be reduced to the percentage value specified in parameter Aa21, "% Torque To Pos Stop". When the TRANS 01-D senses that the motor has stalled, the motor's available torque will be changed to the percentage value programmed in parameter Aa21, "% Torque at Pos Stop". This torque value will still be used for any Dwell or other waiting period, i.e., auxiliary function acknowledgments. The torque value will be switched back to its previous value when the TRANS 01-D executes a G76 program command.

The distance (G91 incremental) or destination (G90 absolute) programmed with this function is the maximum distance the slide will be allowed to travel and should be a point just past the expected positive stop. If the slide reaches this position without the motor stalling, movement will stop, the diagnostic POS STOP MISSING will be displayed and a soft fault will result. To recover, you must press the CE (Clear Error) key. An incremental distance (G91 command) programmed in a block following a feed-to-positive-stop will be based on that point where the stall occurred.

If the theoretical programmed position is too close to the positive stop, the error message 'Positive Stop Missing' will be displayed.

The TRANS-01-D will recognize the positive stop in two ways.

1) The feedback velocity falls below 1% of the commanded velocity and
2) the torque value exceeds the pre-set value in parameter Aa21 - % Torque to the Stop for 48 msec.

If both of the aforementioned situations occur together for 120 msec, the TRANS 01-D will consider the positive stop as found. It will then reduce the drive's torque level to the value set in Aa21 - % Torque at the Stop.

When the theoretical end position of the G75 block is programmed, the theoretical end position should be at least four times the following error past the mechanical positive stop. The following error is calculated as follows:

Following Error = Programmed speed in G75 block / Kv factor (Aa08) * 1000

Program example:

```
N039  G01  G90  G61  Y18  F200   M11100022211
N040  G75  G90  Y21  F112        // Feed to Pos Stop
N041  M00000022200               // AUX I/O
N042  G76  G90  G61  Y0   JS000  // Disable Pos Stop mode
N195  G76  G90  G61  Y0   // Ensure Pos Stop is disabled
```

Explanation:

N039 Absolute move with lag to Y=18 at a feedrate of F=200 and Aux. 1,2,3,10,11 are turned on and Aux. 4,5,6 are turned off.

N040 Feed to a positive stop at Y=21 at a feedrate of 112.

N041 When a positive stop has been achieved, Aux. 1,2,3,4,5,6,10,11 are turned off.

N042 Disables positive stop mode and returns nominal to the Y-axis

N195 Disable positive stop mode (whether enabled or not) on the Y-axis before executing the rest of the homing command.

Adaptive Depth Control (G08)

Adaptive Depth arises from the final depth of a positional move being dependent on the location of the part surface and not the referenced position of the motor encoder. This is made possible by using an external encoder to determine the final position. This form of positioning has the following advantages:

- It compensates for both drive train and work piece variations while the tool is actually performing the cut.
- Using incremental positioning it's possible to program distances relative to the face of the part.

The TRANS 01-D begins adjusting the final depth of a positional move using the secondary device when a G08 (Adaptive Depth Command) is issued in the NC block of the part program. This G08 command must be preceded by a G62 (without lag command)

In an ideal situation, once a G08 command has been issued the drive will continue to move until the position reading from the external encoder is equal to that of the G08 command. But the final position also takes into account whatever minimal deflection may have existed (e.g., due to vibration, mechanical binding etc.) on the external encoder. To do this the TRANS 01-D takes a snap-shot of the external encoder feedback position when it reaches the first NC block containing a G62 move preceding a G08 NC part. In reality the final positional reading of the external encoder equals the deflection seen on the external encoder when the first G62 NC block preceding a G08 was issued *plus* the distance commanded in the G08 NC block.

The final destination point of this G62 move must be such that the external encoder has been depressed by at least 50 micro-meters and not more than the value set in TRANS 01-D axis parameter Aa31 (Linear Encoder Pre-Limit).

If the value of the position in the final G62 block plus the position value located in the G08 block is greater than the value in TRANS 01-D axis parameter Aa06 an over travel fault 'Position out of bounds' will occur.

Once the TRANS 01-D is in any other NC block other than one that contains a G08 command then the external encoder is not being used for positioning.

Hardware and Software Requirements

Indramat Servo Drive	DIAX 03/04 Type Drive
Firmware	TRANS 01-D 06V11 or higher DIAX 03 Drive DSM 2.2 SSE 02V26
Indramat Interface Card	DLF (latest revision)
Indramat Encoder Cable	Type 03-0349
Online Programming Tool	Indramat Visual TRANS software
External Linear Encoder	Heidenhain MT25W (incremental measuring device)

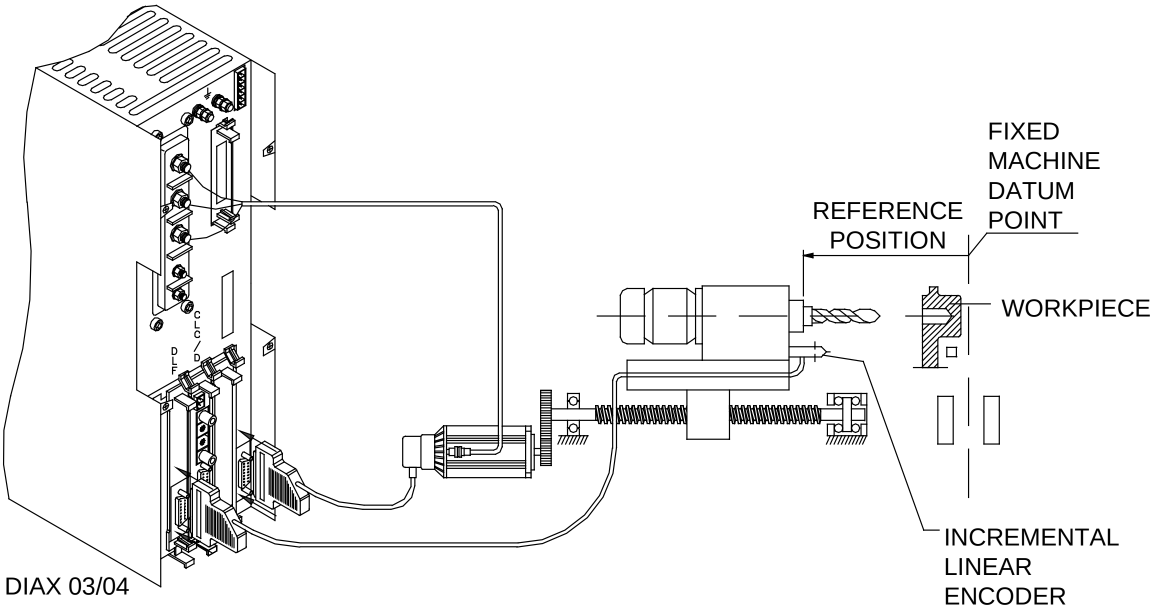


Fig. 4-5: Adaptive Depth Hardware Arrangement

Programming Example

```
N000 JC005:001
......
N009 G01 F90 G61 Z10 F100
N010 G01 G90 G62 Z20 F200
N011 G01 G90 G62 Z27 F50 M22200010000
N012 G08 G91 Z.5 F10 M22200010001
N013 G04 F0.20 M22210010000 JS000
......
N195 G74 Z0 F100 M00010000000 JS000
```

At Z=10 the TRANS 01-D takes a snap shot of the deflection on the external encoder. This will be taken into account when the external encoder is to position 0.5 units (Block N012).

At Z=27 the TRANS 01-D expects to see deflection on the external encoder greater than 50 micro meters and less than the value in TRANS 01-D axis parameter Aa31 (Linear Encoder Pre-limit).

TRANS 01-D moves a depth of 0.5 units on the external encoder from it's position at NC block 10.

Fig. 4-6: Adaptive Depth Programming Example and Sequence

Whatever the amount the encoder is deflected (e.g., by λ) as it begins to execute NC block N012, the TRANS 01-D will move the axis a distance of ($0.5 - \lambda$) under adaptive depth control to equal 0.5 total linear deflection at the end of NC block N012.

Note: If motion on the probe occurs after the G62 command preceding the G08 has been issued, but before the probe has come in contact with the part then this positional variation will not be accounted for by the TRANS 01-D. But this error will be accounted for once the probe moves onto the part (unless there is physical damage to the external encoder).

Set-up Procedure

1. Ensure that the DIAX03/04 drive system is powered off. Install the DLF board.
2. Attach the Heidenhain External Encoder to the DLF board using the Indramat IKS0349 cable.
3. Power up the DIAX 03/04 drive system.
4. Start communicating with VisualTRANS (using RS232) through the serial port " X27 " on the CLC-D card on the DIAX03/04 drive.
5. Using VisualTRANS check that SERCOS parameter "S-0-0030 Manufacturer Version" displays the correct version of DSM - "DSM 2.3-SSE-02V26" or higher.
6. CLC-D card parameter # "C-0-0306 In position window " needs to be set to " .001mm " to ensure that the DIAX 03/04 drive and ext. encoder home correctly.

Configuration Procedure

1. Put the TRANS 01-D into parameter mode.
2. TRANS 01-D axis parameter Aa01, number 2 needs to be set to "1" to activate the G08 (Adaptive Depth Command) in the NC part program block. If a G08 is used in a program without this parameter activated the following error appears: "779 Adaptive Depth not configured for this axis"
3. TRANS 01-D axis parameter Aa03 (Feed Constant) needs to contain an accurate value, of the axis ballscrew that the Adaptive depth is being programmed on, as this value is used to ensure consistency between the motor encoder feedback and the ext. encoder feedback.
4. TRANS 01-D axis parameter Aa30 (Adaptive Depth Max Speed) needs to be set to the maximum allowable velocity when programming a G08 (Adaptive Depth Command). *When using VisualTRANS, this parameter corresponds to axis parameter # 317.* If a value greater than this parameter is programmed in a G08 command block the following alarm appears: "780 Maximum Adaptive Depth feedrate exceeded"
5. TRANS 01-D axis parameter Aa31 (Linear Encoder Pre-limit) contains the value that the TRANS 01-D will compare to the external encoder position at the beginning of the G08 NC block. If the position from the external encoder is greater than axis parameter Aa31, the TRANS 01-D will move to the position within the preceding G62 block *plus* the Pre-limit deflection value and then the following alarm appears: "System: 511 Adaptive Depth Pre-Limit Error"
6. Using VisualTRANS, make SERCOS parameter "P 0-0075 Interface Feedback 2" equal to "2". This configures the DLF board as the source of secondary feedback.
7. Exit from Parameter Mode.
8. To ensure that the External Encoder is feeding information back to the DIAX03/04 drive, push the tip of the MT25W in and out. The position display on SERCOS parameter "S-0-0053 Position Feedback Value 2 Ext. Feedback" should change correspondingly.

Alarm / Diagnostic Number	Cause	Action Required to Reset Condition
425	"Task B: 425 Depth: Probe reading > w3; not zeroed (30)" When referencing the motor encoder (performing a G74) the external encoder was not set to a value less than 50 micro meters.	Ensure that CLC-D card parameter C-0-0 306 In-Position Window is less than 50 micro meters.
511	"Adaptive Depth Pre-Limit Error" The external encoder is deflected more than TRANS 01-D axis parameter Aa31 at the beginning of the G08 part.	1. The part may be out of tolerance and this is a correct diagnostic. 2. The Pre-Limit value in TRANS 01-D axis parameter Aa31 is too small. 3. There is some mechanical blockage with the external encoder.
512	"Adaptive Depth Part Not Found" The TRANS 01-D has reached the position commanded in the G62 block preceding the G08 command plus the Pre-limit value and still has not detected more than 50 micro meters deflection on the external encoder.	1. The part may be out of tolerance and this is a correct diagnostic. 2. Test to ensure data is being read from external encoder by monitoring SERCOS parameter S 0-0053 when external encoder is in motion. There is an error in reading the external encoder data. Problem with external encoder or Feedback cable or DLF card
779	"Adaptive Depth not configured for this axis" A G08 was issued in an NC part program block without TRANS 01-D axis parameter Aa01 being enabled for Adaptive Depth programming.	Make TRANS 01-D Axis parameter 1 such Adaptive Depth programming is enabled.
780	"Maximum Adaptive Depth feedrate exceeded" The feedrate programmed in the G08 is greater than the value in TRANS 01-D axis parameter Aa30.	Decrease the feedrate less then the value in TRANS 01-D Axes parameter Aa30 or increase this parameter greater than the value on the G08 command - depends on the mechanical limitation of the system.
781	"Maximum Adaptive Depth deflection exceeded" The distance traveled by the ext. encoder is greater than TRANS 01-D axis parameter Aa32	Either decrease the distance in the G08 NC block or increase the value in TRANS 01-D axis parameter Aa32 - need to consider mechanical limitations.
813	"G08 depth is less than or equal to Adaptive depth pre-limit"	The value of the axis depth (distance of travel) in the G08 block is less than or equal to the Pre-limit value located in axis parameter Aa31. Example block: G08 G91 G61 Z**10** M10000000000 Axis parameter Aa31 value: **11**

External Feedback Devices - Distance Coded Linear Scale

Note: **This information applies only to TRANS 01-D software versions 06V11 and later.**

For the use of Distance Coded Linear scales, the operation of the TRANS 01-D will remain the same except for the following cases:

- When referencing for the first time after powering up or in those instances where the axis has lost its reference.
- When executing a Home command (G74) when the axis is referenced
- When the user has made changes to the Reference position since the last time it was Homed or Referenced.

Relevant parameters for Distance Coded Linear scales include:

- S-0-0115 Position Feedback Type (set second LSB to 1 to set distance coded linear scale as feedback type for servo drive)
- S-0-0118 Resolution of Linear Feedback
- S-0-0165 distance coded linear scale Distance-coded Reference Dimension 1
- S-0-0166 distance coded linear scale Distance-coded Reference Dimension 2
- S-0-0178 distance coded linear scale Absolute Offset 2

Operation of Servo Drive with Distance Coded Linear Scale

The Distance Coded Linear scale is a hybrid device that initially acts like an incremental feedback device, but once it is referenced to the machine position grid, it will act as an absolute feedback device. The advantage of the Distance coded scale is the user does not have to re-establish a Home position, it only needs to establish where it is in relation to the machine reference point if axis reference is ever lost.

On power-up or when axis has lost its reference, the system will not be referenced. S-0-0403, LSB will be 0. When a Drive Generated Homing Command (G74) is issued, the axis will traverse the distance necessary to pass two marker pulses, in the direction specified in the Homing Parameter Aa11 as the Homing direction. After it has traversed this distance, it will stop moving and display its absolute position as defined by the scale. At this time the servo drive will set S-0-0403, LSB to a 1 to signal that the axis is referenced. Any subsequent Drive Generated Homing Commands (G74) that are issued will be ignored by the drive.

TRANS 01-D Operation

The TRANS 01-D treats the Distance Coded Linear scale as an incremental feedback device in those cases where the axis will loose its reference, i.e., Exiting parameter mode, certain drive errors, or when the system has lost all power. In these cases, if reference is lost, the G74 command initiates a Drive Controlled Homing Procedure to once again reference the scale to the machine slide.

If the axis has not lost its reference, the G74 command moves the slide to the already established Home position. When the axis has been moved to its established Home position, the Home output from the TRANS 01-D Cycle interface goes high.

If the user has changed the value of the TRANS 01-D Reference position by changing the value of the axis word in the Homing Block, the system does not re-establish the Home position, unless it has lost reference. However, it does move the axis to the newly designated Home position and output the Home signal to notify the line control that the axis is at the Home position. If the Reference position parameter value has been changed, the TRANS 01-D once again issues a Drive Generated Homing Command to re-establish its Home position.

The user should enter the value to be displayed when at the Home position using the already established methods, Axis word in the G74 Homing block and by entering a value into the Reference Position parameter (CTA10-1 Aa13 or Axis parameter A-0-0318). These two values are summed and placed into S-0-0054 (Position Feedback 2, Reference Distance) as the value to be displayed when at the Home position.

Rotary Motion Control

The TRANS 01-D has the ability to control a rotary application. This option can be used for applications such as rotary tables or lift and transfer drives. The software will allow programming rotary positions in UNITS/TABLE REVOLUTION. Rotary speeds are also entered in these same units.

Note: The TRANS 01-D can only be configured to control one rotary axis. When used in a multi-axis system, only one of the axes may be rotary.

Rotary software uses conventional TRANS 01-D programming techniques. Only certain motions and/or working units change. The program commands G20 and G21 are functional in rotary operation.

Associated Parameters

Since the system of units for rotary motions is arbitrary, the UNITS parameter gives the user the option of specifying the UNITS/TABLE REV to be used for his application. The software and/or hardware Travel Limits can be used to limit the motion to less than one revolution. As an example, the motion on a typical rotary crank arm transfer drive should not travel greater that 180° for its total travel. Using the Travel limits, any motion outside of 270° - 90° will cause an Overtravel fault.

The standard parameters used for Rotary operation are described below.

Parameter	Description
Aa02	UNITS /TABLE REVOLUTION (set to 360 degrees)
Aa05	GEAR RATIO
Aa10	SPEEDS -- Homing Speed, Rapid Speed, Jogging Speed, Jogging Rapid, Max Cutting and Max Speed to Positive Stop are all expressed in unit/table rev/min.
Aa11	DIRECTIONS: Homing Direction: Determines the direction the axis will move when commanded to Home. Program Direction: This parameter will determine what direction the motor will turn when using G37 and G38 G-codes.

Homing and Zero Offset (NC code G74)

A “0” or a “1” in the Homing direction parameter will cause it to Home in only one direction. When Homing is selected during programming, the TRANS 01-D will display ZERO OFFSET?. The value entered as the zero offset will determine the value of the home position on the absolute grid of the table. For example, if degrees are used as the units (360 units/table rev), and 10 is programmed as the zero offset, home position will be called "10 degrees". If an absolute move to zero degrees is commanded after that, the table would move 10 degrees. No additional motion will occur with the inclusion of a zero offset. It is simply a value to be used for home position once it is reached. If a value other than zero is programmed in the parameter for reference position, this value will be added to the zero offset in the homing block to determine the value for home. Using the above example again, if -25 was programmed as the reference position, home would be called -25 +10, or -15 degrees. Since the display will only show positive values, this would appear as 360-15, or 345 degrees.

Positioning (NC code G90, G91)

When an axis is designated as rotary in the servo drive setup, all positional moves will be made according to the modulo value specified. A rotary axis can be interpolated along with a linear axis. Positioning of the rotary axis can be performed as either absolute positioning (G90) or

Incremental positioning (G91). The G90 and G91 commands are modal in the rotary mode of the TRANS 01-D.

G90 This is the default mode for rotary operation. By default, all G01 rotary motion commanded in the TRANS 01-D will be absolute, using the shortest path for the move. When a positional move is commanded, the axis will move to the programmed destination using the shortest possible path, positive or negative direction, whichever is less than one-half of a table revolution away from the commanded position. The destination may be any value between 0 and the number set in the parameters as UNITS/TABLE REV. No negative values are allowed. To specify a direction for the G90 absolute move, in the cases where the shortest path is not desirable or possible, the user has the ability to use two additional G-codes. These two G-codes, G37 and G38, can be used to specify what direction the axis must take when executing the programmed move.

G91 This command for a rotary axis does not require an additional rotary operation G-code. The G01 positional move command will cause the rotary axis to move the incremental distance specified in this program block. This type of move will cause the axis to move the specified distance from its present position. Direction may be specified by programming the distance as a positive or negative value. The value of the distance is limited to plus or minus the value for the maximum travel distance of the digital drive system in modulo mode.

Note: The G91 command is not valid for G36, G37 nor G38 moves.

NC code G36

This modal command can be used to specify that the ensuing absolute moves for the rotary axis should use the shortest path positioning mode. This is the default mode for all absolute moves. If all absolute positional moves to be made will be made using the shortest path, this command will not be necessary. This command is necessary when the user has completed a move using either the G37 or G38 command and they want the next series of moves to be executed using the shortest path mode. In that case, the user must program the first absolute move that is to use the shortest path using this command. This modal command will then be used for each succeeding program block until it is changed by programming a G37 or G38.

NC code G37

This G-code gives the user the ability to program an absolute (G90) move inside of the modulo value that is greater than 180 degrees away from their current position and choose positive as the direction the axis should travel to that position instead of the axis taking the “shortest path”.

G90 When an absolute positional move is commanded, the axis moves to the programmed destination in the positive direction only. The destination may be any value between 0 and the number set in the parameters as UNITS/TABLE REV. If travel limits are enabled, a programmed move to a destination outside of the specified travel range will generate a travel limit violation error.

Note: When a G91 incremental positioning move is made, if the G37 code is active, it will not effect the direction of the rotary motion. The direction in a G91 move is always determined by the sign of the programmed incremental distance.

NC code G38

The intent of this G-code is to give the user the ability to program an absolute (G90) move inside of the modulo value that is greater than 180 degrees away from their current position and choose negative as the

direction the axis should travel to that position instead of the axis taking the “shortest path”.

G90 When a positional move is commanded, the axis will move to the programmed destination in the negative direction only. The destination may be any value between 0 and the number set in the parameters as UNITS/TABLE REV. If travel limits are enabled, a programmed move to a destination outside of the specified travel range will generate a travel limit violation error.

Note: When a G91 incremental positioning move is made, if the G38 code is active, it will not effect the direction of the rotary motion. The direction in a G91 move is always determined by the sign of the programmed incremental distance.

Rotary Axis Programming Example

This is a programming example for a Rotary Axis using G36, G37, G38 and setting over travel limits in the CTA10-1 / BTC-06 Axis parameter Aa06.

Before setting the valid range of motion for a rotary axis, the user must first determine his range in reference to a unit (0°-360°) circle.

On a unit circle, 0° is located on top. Moving in a clockwise direction from 0° is positive, while counterclockwise is negative.

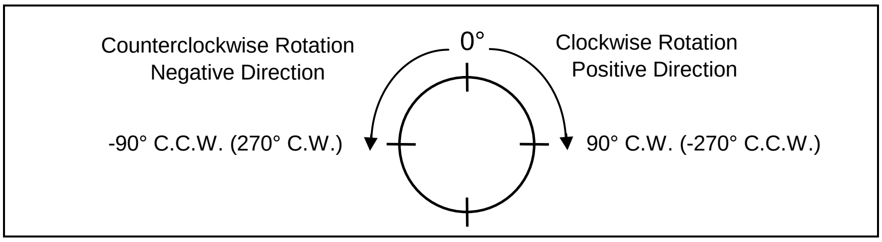


Fig. 4-7: Unit circle rotation

In Fig. 4-8, the range of motion is from **-40º to 71º.**

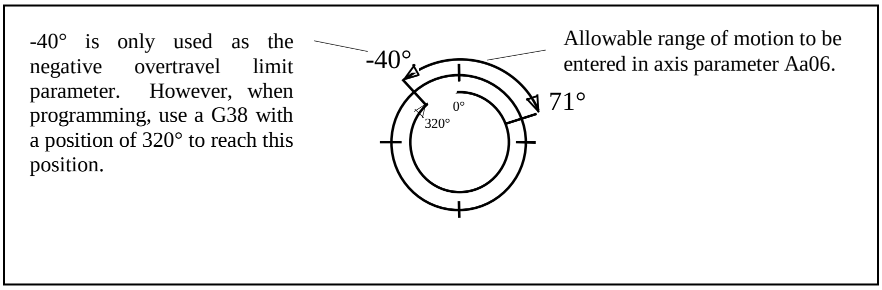


Fig. 4-8: Valid range of motion for rotary axis

Setting of Overtravel limits. To set the values in the CTA10-1 axis parameter Aa06:

Determine the max positive travel limit parameter. In this example its **71º.**

Go in a counter clockwise direction to determine the negative travel limit, i.e., enter **-40º** *not* **320º**)

The positive overtravel limit value in axis parameter Aa06 is **71º**, and the negative overtravel limit is **-40º**. Once these values are set, the allowable range of motion for this rotary axis must be between **-40º to 71º.**

The following figure contains additional examples of "range of motion" for entry of axis parameter Aa06.

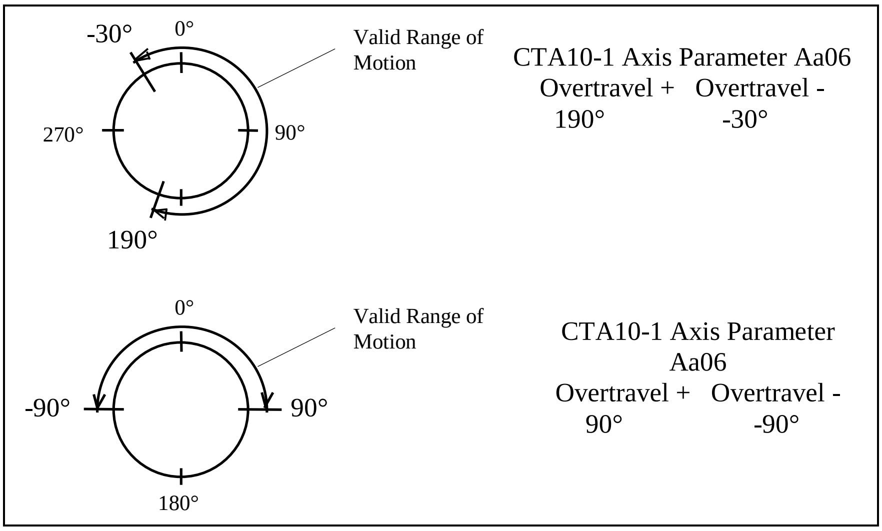


Fig. 4-9: Additional examples of Overtravel range of motion settings

```
N000 M00000000000 JR195
N001 JC010:00001
…….
N008 JS000

N010 M00000000001 JR031
N011 G01 G90 G61 G37 X70.0 F800         // Move Rotary Axis clockwise direction to position 70º
N012 G01 G90 G61 Z20.0 F500 JR024       // Move Linear Axis to position 20 and set Reverse Vector to N024
N013 G01 G90 G61 G38 X321 F700 JR033    // Move Rotary Axis counterclockwise to position 321º and sets the Reverse Vector to N033
N014 G01 G90 G61 Z60.0 F500 JR037       //  Move Linear axis to position 60 and set reverse vector to N037
N015 G01 G90 G61 G36 X0.0 F900 JR195    // Move Rotary axis, using the shortest path, to position 0 º and set Reverse Vector to N195
N016 G01 G90 G61 Z0.0 F500 S0 JS000     // Move Linear Axis to 0, Jump and Stop to N000

N195 G74 X0 F720
N196 G74 Z0 F100 JR195
N197 JS000
```

Fig. 4-10: Rotary programming example

Clamping using G20/G21 program commands

When the cutting force exerted on a rotary table is high, it is possible for the position of the drive train to shift. For this reason, many machine builders will clamp the drive train to prevent unwanted movement. If it is not, the system may attempt to hold a position, or even move the drive train, causing servo overload. The program command G21 is functional in rotary mode to accommodate this need. This program command should be used for no other purpose than clamping or braking the drive train. If G21 is commanded during program execution, the AC Servo Controller Enable will be removed, the drive will go from AF to Ab, allowing free movement of the servo motor (no servo lock). A programmed Auxiliary output can also be used to notify the line control when it is safe to energize the clamp or brake. The Controller Enable will be restored when the G20 program command is executed. During the time that the G21 command is in operation, no movements should be commanded, otherwise an error will appear on the display, resulting in a fault. Only dwell times, block jumps, or waits for acknowledgments should be performed while the G21 command is active.

While the G21 function is in operation, the destination will be made equal to the actual position, so that no jump will occur if the motor is rotated. This means that the next positioning command made after a clamping operation should be an absolute move. Incremental moves would be made referenced to the present position (including any move made while clamped) rather than the last commanded position. If incremental moves are required after a move to positive stop, they should be preceded by an absolute move to the last position, to correct for any shift in position during clamping.

The last move made before a clamping operation should be programmed with lag finishing (G61), so that the motor is stopped in position before the Controller Enable is removed. If the block is programmed without lag finishing, the commanded position may not be reached before power to the motor is dropped.

Typical sequence of events for Rotary Operation:

1. Program is running, table is being positioned.
2. Table is in position (G61 move). Auxiliary output is turned on to signal the Line Control that the table is ready to be clamped.
3. Table is clamped through Line Control logic. Ack. is sent to TRANS 01-D signaling table is clamped.
4. Execute G21 program command. TRANS 01-D brings servo drive from AF to Ab and sets servo motor brake. Turn on programmed Aux. output to signal that the drive is disabled.
5. Machining takes place.
6. Machining is completed. Ack. is sent to TRANS 01-D signaling machining is complete.
7. Execute G20 program command. TRANS 01-D brings drive from Ab to AF and releases brake. Aux. Output is turned on to signal table is ready to be unclamped.
8. Table is unclamped through Line Control logic. Ack. is brought low to confirm table is unclamped.
9. TRANS 01-D begins execution of next program block.
10. Ensure that block N195 re-enables all configured axis. I.e., program a G20.

Rotary Axis examples - Feedrate Interpretation

Feedrates used in conjunction with a rotary motion are interpreted based upon the presence, or lack of, an accompanying linear motion. Three cases can occur:

1. If a rotary axis appears alone in an NC block (i.e., no linear axes programmed), the feedrate is interpreted as angular velocity (modulo units/minute).

Example:

* Rotary Axis = Z

* Module units for Axis Z = 360 units / rev

N000 G01 G90 G61 Z180 F100

In this example, F100 is interpreted as 100 degrees / min (100 modulo units / minute)

2. If rotary and linear axes appear on the same NC block and the linear change in position is zero, the rotary axis will run at maximum velocity (i.e., A-0-0020 Maximum Velocity)

Example:

* Rotary Axis = Z

* Linear Axis = X

* Module units for Axis Z = 360 units / rev

* Units for Linear Axis = Inches

N000 G01 G90 G61 X10 Z180 F100 (X is already at 10)

-or-

N000 G01 G91 G61 X0 Z180 F100

In both of these examples, since the axis is already at the commanded destination, the F100 will be ignored, and the axis will run maximum velocity (i.e., A-0-0020 Maximum Velocity).

3. If rotary and linear axes appear on the same NC block and the linear change in position is nonzero, the feedrate is interpreted as linear velocity and the rotary axis velocity is slaved to the linear motion. Slaved means the rotary speed will be proportioned so that the rotary axis finishes its move at the same time the linear path is completed. If the resulting speed of the rotary axis would be greater than maximum velocity (i.e., A-0-0020 Maximum Velocity), the rotary axis' speed will be limited to that value.

Example:

* Rotary Axis = Z

* Linear Axis = X

* Module units for Axis Z = 360 units / rev

* Units for Linear Axis = Inches

* A-0-0020 = 2000 degrees / minute

CASE (1)

N000 G01 G90 G61 X10 Z180 F100 (X is at 0)

Feedrate is interpreted as 100 Inches / min. X will complete it's move in 6 seconds, so Z will be run with 1800 degrees / minute ((180 degrees/6)*60).

CASE (2)

N000 G01 G90 G61 X5 Z180 F100 (X is at 0)

Feedrate is interpreted as 100 Inches / min. X will complete it's move in 3 seconds, so Z is calculated to run with 3600 degrees / minute ((180 degrees/3)*60).

Feedrate (NC Code F)

In order to enable position commands, a feedrate must be programmed. It is good practice to always enter a feedrate in a NC Block, unless program operation dictates a NC Block without a feedrate. Feedrate values are modal. If a feedrate is programmed in a NC Block, it will be used for any positional moves in each subsequent NC Block, unless the feedrate is changed in a subsequent NC Block. Feedrate values up to the rapid speed parameter's value (Ax10) may be programmed.

Dwell (NC Code G04)

A dwell is programmed to allow time for some action to occur, such as a dwell programmed after a forward cutting motion to allow a drill to clean the hole and prevent burrs.

Dwell times can be programmed from 0.01 to 99.99 seconds.

Tool Corrections (NC Code T)

The TRANS 01-D includes a feature which allows programmed corrections to be entered to compensate for changes in the tool or part dimensions. Program entry is in a two-digit tool correction register, which has an associated correction (or compensation) value. Nine (9) Tool Correction registers are available per servo axis, plus additional registers for External Tool Correction. The registers for each axis are;

Axis	Internal Register	External Register
X axis	T11 - T19	T01
Y axis	T21 - T29	T02
Z axis	T31 - T39	T03

The values in registers Tx1 - Tx9 per axis can be either positive (+) or negative (-). Positive values will be assumed if no sign is entered along with the register's value. These values can be entered through the CTA10-1 keypad or through the RS232 port on the front if the TRANS 01-D. Register Tx0 is used in the program to clear the Tool Correction memory (i.e., X axis is T10, Y axis is T20, Z axis is T30). External registers do not have a clear, as any new value entered will overwrite the existing value.

When the TRANS 01-D is operating, the correction value in the specified tool correction register will be added to the programmed position value. The target position of the TRANS 01-D is the sum of the programmed position and the correction value. If the total distance programmed exceeds one of the software Travel Limits, the TRANS 01-D will issue the soft fault “Axis position is out of bounds”.

Zero setting of the tool correction memory is accomplished by specifying tool correction register Tx0. Tx0 is only used to clear the value in the correction memory and cannot be used as an actual tool offset value.

Tool Correction registers can be viewed in both Manual and Automatic modes by pressing the Tool Correction Register key on the CTA10-1. Tool Correction registers can only be edited in Manual mode.

Entering Tool Correction Register Values

The TRANS 01-D allows the tool-setter the ability to enter one or more correction values to compensate for tool wear or, when changing tools, to compensate for differences between tools. The operating program is written to refer to one of these values by its tool correction register number (as described on the previous section). The correction value in the referenced register is then added to the programmed dimensions to compensate for tool wear or the difference between tools. Refer to Tool Correction on page 4-13 for an example for setting a tool correction.

Note: The tool correction values can be positive or negative. The magnitude of the value entered into a register is limited by the axis parameter Aa15 "Maximum Tool Correction". Each axis has its own parameter and they need not be set the same. For example, setting AX15=0 and AZ15=10 disables Tool Correction on the X axis (because values other than 0 cannot be entered) and sets the valid range for the Z axis to –10 to +10 mm or inches (depending on which units are configured in the system). For firmware versions prior to TRANS 01-D 06V43 and CTA 06V12, the maximum could be set to any number up to +/- 3.0000 inches or +/- 30.000 mm. For firmware versions TRANS 01-D 06V43 and CTA 06V12 and later, the maximum value is increased to +/- 99 inches or +/- 99 mm.

Programming Tool Corrections

To program a Tool Correction offset into a program NC Block, the function command Txx must be used. When the Txx function is programmed in a NC Block, the Tool Correction register programmed must coincide with the axis programmed (see table on previous pages). The following example shows how a Tool Correction register is specified in a program NC Block.

N001 G01 G90 G62 Z4.56 F8 **T31** M1000000

N002 G01 G90 G62 Z0.0 F150 **T30** M0100000 JS000

In this example, Tool Correction register #31 was programmed. Before this NC Block is executed, the TRANS 01-D will verify that the programmed position plus the Tool Correction register's value will not move the slide beyond a software Overtravel Limit (axis parameter Aa06). If the move will take it beyond the Overtravel Limit if executed, the TRANS 01-D will issue an error (Axis move is out of bounds) before the program NC Block is executed. It is recommended to clear the Tool Correction memory after the end of each axis' program cycle. To do this, the return NC Block in the cycle must be programmed with the Tx0 Tool Correction register for the appropriate axis. In the example above, Tool Correction register T30 clears the Tool Correction memory for the Z axis.

External Tool Correction

Tool Correction registers can also be programmed from an external device to the TRANS 01-D through the RS232/485 port on the front of the TRANS 01-D. The protocol used to do this is the same protocol used to communicate with the TRANS 01-D using “Terminal Mode”. The TRANS 01-D has Tool Correction registers T01 – T03 set aside for this function. Programming these Tool Corrections is the same as it is for the internal registers.

The Tool Correction device is connected to the TRANS 01-D at the CLC/D board’s serial port A (i.e., X27), using an RS-232 electrical protocol or the data can be sent via the Interbus-S PCP channel. The serial communication characteristics are as follows:

- 9600 baud
- no parity
- 8 data bits
- 1 stop bit

The Tool Correction data transmitted to the TRANS 01-D is contained in the CLC communication protocol packet described below:

```
>  FP 0.1 123...456 $cs\r\n
| | | | | | | | | | |            |    |
| | | | | | | | | | |            |    End of Message (0x0D 0x0A)
| | | | | | | | | | |            Hex ASCII Checksum
| | | | | | | | | | Variable Length Data (Floating Point number)
| | | | | | | | | Blank (0x20)
| | | | | | | | Data Number Identifier (Floating Pt. Register #1)
| | | | | | | Period (0x2E)
| | | | | | Data Set Identifier (Active Program)
| | | | | Blank (0x20)
| | | | Command Subclass (Data)
| | | Command Class (Floating Point Variable)
| | Blank (0x20)
| Blank ((0x20)
Start Character (0x3E)
```

To compute the checksum, do a 16-bit accumulation of all of the characters **before** the '$'. Then add the most significant byte of the checksum to the least significant byte. Negate this value to form the two's complement. The last 2 digits of this result is the checksum to be transmitted to the CLC-D.

The End of Message consists of Carriage Return and Line Feed characters (0x0D 0x0A).

For example:

```
Checksum on: >  FP 0.1 1.23
                                    0x3E     >  (Greater than symbol)
                                      20     Space
                                      20     Space
                                      46     F
                                      50     P
                                      20     Space
                                      30     0
                                      2E     .  (Decimal point)
                                      31     1
                                      20     Space
                                      31     1
                                      2E     .
                                      32     2
                                      33     3
                                      20     Space
                                      ----
                                      2C7

                                        C7 (least significant byte)
                                        +2  (most significant byte)
                                        ---
                                        C9
                             TRANS 01-D Checksum = (100) - (C9) = 37

The complete command to send in this example is: >  FP 0.1 1.23 $37\r\n
```

The response of the TRANS 01-D after receiving a valid communication packet is to simply echo back the packet header. For example, the TRANS 01-D's response to the above example would be;

> FP 0.1 $1C\r\n

If the checksum calculated by the TRANS 01-D does not match the checksum value in the message sent to TRANS 01-D, an error message is sent from the TRANS 01-D starting with an "!" in the data field. For example, if the above command is sent with the checksum value missing or incorrect, the TRANS 01-D will respond with the error message:

> FP 0.1 !13 Checksum Error: 37 $2F

Note that the value of the checksum of the data received by the TRANS 01-D is included in the error message. In this case, the data was received correctly and the control calculated the checksum of the data to be 37 but the received value of checksum after the data was not 37.

After the correct External Tool offset value has been sent to TRANS 01-D, you must also send a handshaking signal to TRANS 01-D to let it know that the value currently in the offset register is valid for the current program block. This handshaking requires you to send a non-zero value to Global Integer 2. Typically a value of one (1) is sent. When the TRANS 01-D executes a program block with an external offset register specified, it checks to see if the Global Integer's value is <u>not zero (0)</u>. To set this value to one (1), send the following data string to the TRANS 01-D after the correct value has been sent to the offset register:

> GP 0.2 1 $C8\r\n

- G - indicates a global Integer.
- P - indicates you want to read/write data.
- 0.2 - requests access to Global Integer #2.
- The "1" is the data value sent. This can be any non-zero value.

- $C8 – The checksum of the data part of the message in this example.
- \r\n – The end of line characters (0x0D 0x0A).

If the TRANS 01-D receives the command properly, it will respond with the message:

> GP 0.2 $1A\r\n

When the T01, T02, or T03 tool correction code is executed during program block execution, the TRANS 01-D will look for this integer value to be non-zero. If it is zero, the TRANS 01-D will stop program block execution and issue an error message to tell the user this situation exists. When the value is non-zero, the TRANS 01-D will transfer the tool correction value that has been written to Float variable #1 to the corresponding offset depending on whether T01, T02, or T03 is programmed and then set the handshake global integer (GI2) to zero. Doing this prevents the TRANS 01-D from executing another cycle with an invalid data value.

The Tx0 value that should be entered into the program block to clear the Tool Offset is T10 for X axis, T20 for Y axis and T30 for Z axis. These are the same commands used for internal Tool Offsets.

For those cases where the user wants to enter External Tool Correction values, but does not want to implement the handshaking, external data can also be to sent into the standard Tool Correction registers. In order to do this, the user must send the tool data as specified above, except the Tool Correction register specified must be one of the standard registers. When used in this way, the TRANS 01-D will execute the user program, reading the Tool Correction register's value during program execution, but it will not monitor the handshaking signal for data validation.

Caution: Because there will be no handshaking when an external measuring system writes directly to internal offset registers without using T01, T02 or T03, the TRANS 01-D will not set Global Integer #2's value to 0. The user should be aware that this method does not allow the TRANS 01-D to validate the data per program cycle and could allow the wrong Tool Correction value to be used for the specific part being machined. To avoid this, the user must also make sure that the new Tool Correction value is sent down before the TRANS 01-D begins its program cycle. This will assure that the correct value will be used when the cycle is initiated. The checksum for the data string must still be sent with the data. When entering Tool Correction register values in this way, the data header and checksum response should be checked by the sending program in the external device to be sure the TRANS 01-D received the data without a checksum error. If an extra measure of data checking is desired, the value can be read back from the TRANS 01-D by sending only the header without a value and comparing with the value that was sent. For the example below, the read command would be > FP 0.31 \r\n to read the current value in register T31..

The table below shows the proper addressing for externally entering data into the standard Tool Correction registers.

Axis	**Standard Tool Correction register #**	**Corresponds to Floating point #**
X axis	T11 - T19	11 - 19
Y axis	T21 - T29	21 - 29
Z axis	T31 - T39	31 - 39

Syntax example: > FP 0.31 0.547 $C9

- F – indicates a floating point Integer.
- P – indicates you want to read/write data.
- 0.31 – requests access to Floating Point register #31 (the first standard Z axis tool correction register).
- 0.547 – data sent to standard Z axis tool correction register 31
- $C9 – The checksum of the data part of the message in this example.

Substituting any other Floating Point register in the above data string will send the data to the Floating Point register that corresponds to the Tool Correction register for the desired axis.

Notes: 1) The Checksum must be calculated for the station address, register number, and value being sent. The Checksum is necessary when sending data to the TRANS 01-D card in an actual application.

2) In all of the above examples, a space is used as the station address. This is a wildcard that causes the TRANS 01-D to respond regardless of its configured card number. This is valid if the connection is point-to-point between the external device and a single TRANS 01-D (e.g., using RS-232 to a serial port). If using RS-485 in a multi-drop connection to more than one TRANS 01-D, the actual station number for the desired card must be sent. Insert the Hexadecimal ASCII value of the card number followed by a single space. For example, >12 FP 0.31 0.547 $86\r\n writes the value 0.547 to the first Z axis offset of the TRANS 01-D configured with card address 18.

Spindle Speed Control (NC Code S)

Spindle speeds may be programmed in any NC Block in the user program, provided it is enabled in the parameters. Spindle velocity control is achieved via a SERCOS command. Spindle speeds from 0 to the maximum spindle speed (set in parameters) may be programmed. The value is programmed directly in output speed (e.g., tool RPM). Whenever a NC Block contains a spindle speed command, the spindle will first be commanded to run at the new speed, the TRANS 01-D will wait for acknowledgment that the spindle has reached that speed then the remainder of the NC Block (positioning, homing, dwell, etc.) will be executed.

Any time a spindle speed of zero is commanded, the spindle's enable is removed (spindle disabled) after zero RPM is reached. This allows the spindle to be free to move.

Spindle Positioning Control (NC Code P)

A spindle positioning function is available, and when enabled via process parameters P06, may be programmed in any NC Block in the user program. The G01 command must be used in the program NC Block along with the Pxx.x program command to position the spindle. Because the TRANS 01-D considers positioning the spindle as an axis positioning command, no other axis (X, Y, or Z) can be programmed in the same NC Block when positioning the spindle. Position values from 0.0 degrees to 359.9 degrees, in 0.1 degree steps, may be programmed.

After a spindle positioning procedure, the spindle's enable remains high, meaning the spindle is rigidly held in position. In cases where this is undesirable, such as automatic tool changers, simply programming a spindle speed of zero RPM after the positioning procedure (i.e., in the next NC Block) will drop the spindle enable, allowing the spindle to be freely moved.

TDA, KDA or RAC (DIAX01)

The positioning of the spindle is carried out using a drive internal positioning procedure. When the TRANS 01-D executes a spindle positioning command, it sends the programmed position to the spindle drive. After the position has been sent to the drive, the TRANS 01-D will initiate the positioning procedure. This internal procedure will position the spindle according to the parameter values set for speed and direction. Therefore, the sign of any position value programmed will be ignored. It will also send a return signal to the TRANS 01-D once the positioning is complete. Every spindle positioning command sent to the DIAX01 spindle drive will re-initiate the internal positioning procedure. Because of this, if the same position is programmed in successive blocks, each block executed will result in the spindle moving to the programmed position, even if the programmed position is the same for each block.

DDS 2.1, DDS 3.1, DDC 1.1 or DKS 1.1 (DIAX02)

When this servo drive family is used as a spindle drive, it uses two different procedures for orienting. To operate these drives as spindles, the mode of the drive must be set to “rotary”. This will allow the user to position the axis within the rotation of the tool. In rotary mode, there are three possibilities for positioning direction. If shortest path is chosen, the drive will position the spindle the same as it would position any rotary axis. If Positive or Negative direction are chosen, the drive will execute the internal “Drive Controlled Homing procedure” to position the spindle, using the Marker Pulse as its reference and the programmed position as its offset and zero reference. Therefore, the sign of any position value will be ignored. Because it uses the Homing procedure, it will position differently than when shortest path is chosen. The differences are listed below.

1. Shortest path – If the user has chosen “shortest path” for orienting, when the TRANS 01-D executes the spindle positioning command, it will move the spindle to the programmed position taking the shortest path (less than 180°) from its current position.
2. Positive direction – If the user has chosen positive only for orienting, when the TRANS 01-D executes the spindle positioning command, it will move the spindle to the programmed position using the Drive Controlled Homing procedure. The speed and direction it will use for the positioning will be determined by the values entered into the axis Homing Speed and Homing Direction parameters. Because it is using the Homing procedure, once the axis is positioned, any subsequent positioning command will cause the axis to re-home itself to the new position. The exception to this is if the subsequent positioning command is to the same position, the axis will not re-position itself.
3. Negative direction – If the user has chosen negative only for orienting, when the TRANS 01-D executes the spindle positioning command, it will move the spindle to the programmed position using the Drive Controlled Homing procedure. The speed and direction it will use for the positioning will be determined by the values entered into the axis Homing Speed and Homing Direction parameters. Because it is using the Homing procedure, once the axis is positioned, any subsequent positioning command will cause the axis to re-home itself to the new position. The exception to this is if the subsequent positioning command is to the same position, the axis will not re-position itself.

DDS 2.2, DDS 3.2, DKR (DIAX03) and HDD, HDS (DIAX04)

When using either of these two drive families for spindle drives, the user must use drive firmware type SHS. Drive firmware type SSE should not be used in these drives for spindle applications. These drive families, with SHS type firmware, operate similar to the DIAX01 family, except the

spindle is positioned directly with the programmed position. The direction of the orientation can be changed by changing the sign of the programmed position.

Program example:

N010 G01 G90 G61 X10 Y10 S100

N011 S0

N012 G01 G90 P180 F100

N013 JS000

Explanation:

N010 **//** Spindle Reaches 100 RPM before X & Y axes begin their motion

N011 // Spindle speed reduced to zero (0)

N012 // Spindle orientates to 180° at 100 degrees per minute

N013 // Program jumps to block N000 and stops

Auxiliary Functions (NC Code M)

Auxiliary function outputs are available in the system. They are used to operate position dependent functions such as solenoids, switches, clamps, full depth indicators, lights that must be turned on dependent on a position, etc.

Auxiliary functions can be turned on, off or left unchanged by entering a 0, 1 or a 2 in the proper command positions. When an auxiliary function is selected, it is turned on or off at the completion of the G-code (movement or dwell).

An acknowledgment may be required for the programmed auxiliary functions, depending on the I/O system used. When the command is executed, the TRANS 01-D awaits the acknowledgments for any functions which were turned on or off before it executes the next NC Block. Once an acknowledgment is issued, the signal line must be held in that state until the function output changes. If not, program execution halts and a soft fault occurs.

Auxiliary Acknowledgment Definition:

M 0 1 2 1 1 1 1 1 1 0 0

0 - requires input to be always low

1 - requires input to be always high

2 - does not change the output and does not monitor the state of the input. I.e., if the input changes from 0 to 1, the TRANS 01-D will not issue a fault.

There is one important exception to the above. The TRANS 01-D allows a jump to the reverse program to be performed even if the acknowledgments do not match their associated auxiliary outputs. This can occur on an emergency return or upon recovery from a power failure. In this case, in the first NC Block of the Homing program it is necessary to insure that all auxiliary outputs are forced into a state where they match their acknowledgments. The easiest way to do this is to program the first NC Block of the reverse program (usually 195) to turn off all auxiliary functions and program the next NC Block with a Homing function. Assuming all acknowledgments will also be off then, homing will always be possible. When programming this, of course, it must be certain that axis movement is possible and safe with all outputs off.

Program example:

N100 M00010122211 JS000

Explanation:

N100 **//** Acknowledge state of inputs then jump and stop program on block 000

Program Jumps

Several types of program jumps are available, as discussed in the following paragraphs. If program jumps have been selected in a NC Block together with other functions, their execution will occur at the end of the NC Block, after all other functions have been executed.

Note: Block Jumps cannot be programmed in a NC Block if motion is programmed with G62 (Without Lag Finishing).

Unconditional Jump (NC Code JN)

With an unconditional jump the TRANS 01-D transfers control to another NC Block anywhere in the program. This allows the programmer to change the sequence of program execution. This is helpful when patching programs. The required new program section can be written into some available NC Block locations and tied to the original program by an unconditional jump instruction. A jump instruction at the end of the new program section can transfer control back to the original program.

Conditional Jump (NC Code JC)

A conditional jump transfers program control to the specified NC Block only if the programmed condition exists on the conditional jump control inputs. These are user interface inputs, allowing the user to determine via external signals (such as selector switch inputs) whether a programmed jump should be executed.

Example: Assume the TRANS 01-D has three different programs which start at the following NC Block numbers:

Program 1 --- Block 015
Program 2 --- Block 026
Program 3 --- Block 034

Any of these three programs can be executed, based on the position of a selector switch, by programming the following routine (starting at NC Block N000) with conditional jumps.

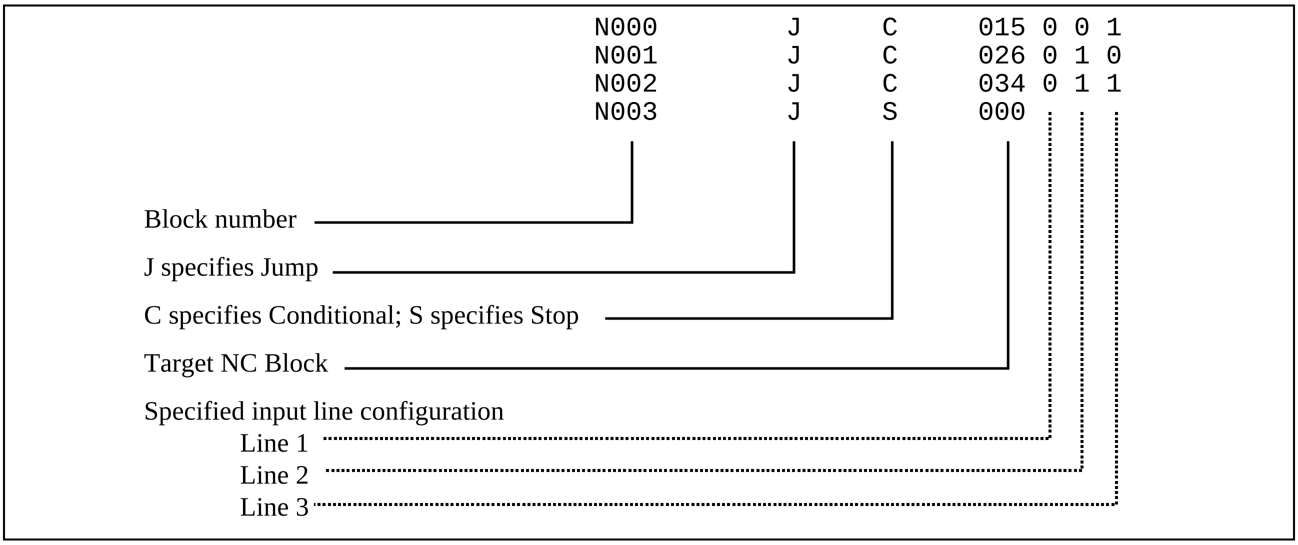


Fig. 4-11: Conditional Jump Example

In the above example, the program starting at NC Block N015 is executed when Line 3 of the selector switch is high and all others are low. The program at NC Block N026 is executed when Line 2 of the selector switch is high and all others are low; and the program at NC Block N034 is executed when Lines 3 and 2 are high and Line 1 is low.

Block 003 is programmed with a Jump To Block 000 And Stop. In the case where the selector switch has an invalid input combination, this will cause the program to return to the beginning and stop, rather than proceeding in an uncontrolled manner.

Note: Conditional jumps may point only to NC Blocks which contain valid program instructions.

Jump And Stop (NC Code JS)

The Jump And Stop instruction causes an unconditional jump to the target NC Block and subsequent stop of the program without execution of that target NC Block. Continuation of the program occurs only after a Start signal is issued again.

This instruction is used mainly at the end of a machining program, where a Jump To Block 000 And Stop instruction is required. Jump And Stop can also be used at other positions in a program, if it is desirable to continue the program only after a renewed state.

Reverse Vector (NC Code JR)

When an executing user program is interrupted with a Home (Reverse) signal, and the axis is to be returned to the Home position, it is often necessary to execute different program sequences depending on the status of the user program at the time the Home (Reverse) signal was received. For example, if the tool is in the part, your Home (Reverse) program may be different than if the tool were at the face of the workpiece. This situation may occur in slide units, both during manual operation, when the Reverse input is triggered, and during automatic operation when the Homing input is triggered.

A special type of jump command, the Reverse Vector Jump, specifies with which NC Block the Return program is to start when a Reverse or Homing signal is issued. In the original TRANS01 "Blue Box" the reverse vector was set to NC Block N120 and in TRANS 01-D version 5, the reverse vector was set to NC Block N195 when reset was executed. However, in the TRANS 01-D version 6, the reverse vector is maintained as the last programmed reverse vector. It is recommended that block N195 be programmed with the basic homing program. At any point in the forward program you can use the Reverse Vector Jump command to set some NC Block other than NC Block 195 as the start of your Return (Reverse) program.

A starting point programmed in this manner will remain effective until it is replaced by a new reverse vector of the same type executed in your program. This allows coordination of very complicated Reverse programs within the user program with a minimum of programming overhead.

Reverse Vector JR000

Because NC Block 000, the starting NC Block of the program, could never be used as a reverse vector, reverse vector JR000 is used for a special purpose. Whenever the TRANS 01-D executes a NC Block containing a reverse vector of JR000, it considers all following NC Blocks to be the return portion of the part program, even if they specify forward motions. Reverse vector JR000 is useful primarily in manual mode, but also has an important effect in automatic mode.

In Manual Mode -- You should program a NC Block containing a Reverse Vector Jump to JR000 to indicate the end of the Forward program (profile). In Manual Mode, pressing and holding the FORWARD button at the operator Station causes the TRANS 01-D to execute the Forward program. When the TRANS 01-D completes execution of a NC Block containing a reverse vector of JR000, the Forward input will be ignored and only the Return (Reverse) input can be used.

Note: if reverse vector JR000 is not programmed at the end of the Forward program, depressing the Forward button while in

manual mode will cause the TRANS 01-D to execute the entire program, both the Forward and Reverse profiles.

It is good practice to program a homing command in the part program after reverse vector JR000, however it is not required. The TRANS 01-D operates correctly without the homing command in all cases, except where all power has dropped after execution of reverse vector JR000 and before execution as the Jump to Block 000 and Stop.

Some users omit the homing command in reverse vector program to reduce cycle time. Instead, they program an absolute move to the home position. Unlike many other controls, the TRANS 01-D executes a complete homing process only when first powered up if an incremental encoder is present. If the system contains all multiturn encoders no referencing is required. Subsequent homing commands are essentially an absolute move to the home position, with the TRANS 01-D remembering where Home is and checking that it is reached when commanded.

’Jump on Event’ Program

Jump on Event is a jump that is executed when the Jump on Event input to the TRANS 01-D goes high. When the Jump on Event input goes high, the TRANS 01-D immediately jumps to NC Block N170 and begins to execute the program from that point. When this happens, the TRANS 01-D sets an internal flag to specify that it is running a “Jump on Event” program. While this flag is set, no other Jump on Event inputs are recognized. After the “Jump on Event” program is finished, the flag is reset.

Programming Blocks for the ’Jump on Event’

The “Jump on Event” program begins with NC Block N170 and ends with program NC Block N179. The “Jump on Event” program can be extended if a jump is made to another section of programming NC Blocks that are available other than N170 to N179.

Programming Procedure

Inside a “Jump on Event” program, you can use all the same programming options as in the normal TRANS 01-D program. The program must start in NC Block N170 and must end either with a programmed jump in NC Block N179, with a 'Jump and Stop to 000', or a JReturn, which causes the TRANS 01-D to return to the program block it was executing when the Jump on Event input went high.

```
N000  G01   X99   F500
N001  G04   F2    S1000
N002  G01   X110  F500

N003 G01 A X50 F500 Traverse
N004 JS000
```

```
Signal JUMP ON EVENT

N170 G01 G91 X10 F50
N171 JU070
N172 JN 179
N179 JN 003

N070 G04 F2 S500
N071 G01 G90 X99 F100
N072 Jreturn

’JUMP ON EVENT’
Program
```

Fig. 4-12: Jump On Event Programming Example and Program Sequence

Jump to Subroutine JU

Programs which contain identical program sequences in two or more places can be simplified by designating these identical sections as

subroutines or subprograms. These subroutines can be executed (called) from the main program by executing a Jump To Subroutine instruction.

When the Jump To Subroutine occurs, the TRANS 01-D transfers program execution to the NC Block number specified in the Jump instruction while storing the number of the NC Block which initiated the jump to subroutine. When the TRANS 01-D encounters a JReturn instruction in the subroutine sequence, it returns program control to the main program NC Block from which it executed the Jump To Subroutine instruction. Program execution then continues with the next NC Block. A Jump To Subroutine can be executed from any point in the main program and a return to that point is assured after completion of the subroutine.

Note: A Jump To Subroutine must jump to a valid NC Block.

Subroutines are programmed just like main programs. Note, however, that a subroutine must always contain a JReturn instruction as its last entry. However, a JReturn may not appear in a program which has not been declared as a subroutine, because this would confuse the program sequence.

JReturn

Used to return the user program back to the block that was left with a JU (Jump to Subroutine.) This block jump can also be used to return the program back to the block that was being executed when the Jump on Event input was set high.

5 I/O Functional Description

5.1 Introduction

This chapter provides a functional description of the TRANS 01-D interfaces to the machine builder's equipment and describes the power interrupt handling features of the TRANS 01-D. Also included here is a description of how to configure or re-configure I/O hardware.

These interfaces to machine builder's equipment are:

- Interface to the Operator Station which contains the pushbuttons for manual controls
- Cycle Interface to the customer's Line Control, usually a programmable control which controls automatic operation of the system
- I/O Networks.

When a network is present, Process Parameter P02 is used to specify whether signals are accepted from the I/O Network or from the Cycle Interface.

Other inputs and outputs are provided, including:

- Conditional Jump input lines
- Overtravel and limit switch inputs
- Emergency stop circuit inputs/outputs
- Auxiliary Function outputs
- Acknowledgment inputs

The various signals on the TRANS 01-D interfaces are described below.

5.2 I/O Hardware Configuration and Reconfiguration

It is not necessary to enable the drive that contains the I/O card in order for the TRANS 01-D system to function. It is, however, necessary to specify where the DEA4 and/or the DEA5 I/O card(s) is(are) located. The TRANS 01-D receives its discrete I/O information from the drive into which the DEAx card is installed. When it wants to control the I/O, it sends the command to the drive that contains the I/O card via the SERCOS telegram. This drive then passes the I/O information to the I/O card. If the I/O card is not specified, the TRANS 01-D does not know which drive needs the I/O information.

In the case of the DEA28 and DBS3 cards, there is a daughter card connector between the TRANS 01-D and the cards. The TRANS 01-D sends and receives the I/O data through this connector.

If you wish to change drive numbers (change the SERCOS switch settings), you must first disable all of the affected axes and cancel the I/O card configuration settings (Process Parameter P02, Axis Configuration). You can then power down the system, change the switch settings and then power up the system. After the system has finished initializing, go into Parameter mode and re-enable the affected axes and re-designate the I/O configuration. Failure to follow this procedure could cause a "413: I/O Board not found" error that can only be cleared by restoring the system pre-switch change configuration. After that, follow this procedure to change drive numbering configurations.

Similarly, if the I/O card is to be moved to another drive, remove associated I/O configuration setting from the current drive, then power down the system. Place the I/O card into its new drive location and power up the system. After the system has finished initializing, go into Parameter mode and configure the I/O card to the proper axis.

5.3 TRANS 01-D I/O Description and Usage

The following tables will contain the I/O structure as used by the TRANS 01-D and connected I/O devices.

Input Description and Usage Overview

This table contains all inputs used with TRANS 01-D and associated I/O configuration. All input signals are normally low.

Input Description	DEA28.1M Connector X72 Pin #	DBS03.1M IBS 1 or 2 Object # - Bit	DEA04.x Connector X17 Pin #	DEA05.x Connector X32 Pin #	Specification on page
Enable	1	5FB1-0	4		5-14
Enable Forward	2	5FB1-1	1		5-14
Auto / Manual	3	5FB1-2	2		5-14
Fault Clear	4	5FB1-3	7		5-17
Home Request	5	5FB1-4	8		5-16
Start	6	5FB1-5	3		5-19
Manual Spindle Enable	7	5FB1-6		14	5-14
Forward	8	5FB1-7	5		5-15
Reverse	9	5FB1-8	6		5-15
Jump **O**n **E**vent	11	5FB1-10	15		5-20
Hand	22	5FB3-2		13	5-21
X Axis Jog	23			8	5-18
Y Axis Jog	24			9	5-18
Z Axis Jog	25			10	5-18
S Axis Jog	26			11	5-18
Invert Axis Jog Direction	27			12	5-18
Diagnostic Request LSB	28				5-27
Diagnostic Request MSB	29				5-27
Jump **C**onditional 1	30	5FB2-3	12		5-20
Jump **C**onditional 2	31	5FB2-4	13		5-20
Jump **C**onditional 3	32	5FB2-5	14		5-20
Jump **C**onditional 4	43	5FB2-6		1	5-20
Jump **C**onditional 5	44	5FB2-7		2	5-20
Ack Input 1	45	5FB2-8	9		5-24
Ack Input 2	46	5FB2-9	10		5-24
Ack Input 3	47	5FB2-10	11		5-24
Ack Input 4	48	5FB2-11		3	5-24
Ack Input 5	49	5FB2-12		4	5-24
Ack Input 6	50	5FB2-13		5	5-24
Ack Input 7	51	5FB2-14		6	5-24
Program Reset	52	5FB2-15		7	5-24
X Axis Jog plus		5FB1-11			5-18
X Axis Jog minus		5FB1-12			5-18
Y Axis Jog plus		5FB1-13			5-18
Y Axis Jog minus		5FB1-14			5-18
Z Axis Jog plus		5FB1-15			5-18
Z Axis Jog minus		5FB2-0			5-18
S Axis Jog plus		5FB2-1			5-19
S Axis Jog minus		5FB2-2			5-19
Parameter Mode		5FB3-0			5-21
Programming Mode		5FB3-1			5-22
Continuous Mode		5FB3-3			5-22
Single Block Mode		5FB3-4			5-22
Velocity Override 1		5FB3-5			5-22
Velocity Override 2		5FB3-6			5-22
IBS Multiplexing		5FB3-7			5-34
IBS Multiplexing		5FB3-8			5-34
IBS Multiplexing		5FB3-9			5-34
IBS Multiplexing		5FB3-10			5-34
Comm Header Enable		5FB3-12			5-21
Cycle Start		5FB3-13			5-21
Cycle Stop		5FB3-14			5-21
Rapid		5FB3-15			5-22

Table 5-1: Input description and usage

Output Description and Usage Overview

This table contains all outputs used with TRANS 01-D and associated I/O configuration. All outputs are normally low.

Output Description	DEA28.1M Connector X72 Pin #	DBS03.1M IBS 1 or 2 Object # - Bit	DEA04.x Connector X17 Pin #	DEA05.x Connector X32 Pin #	Specification on page
No Fault	12	5F91-0	16		5-23
Ready	13	5F91-1	17		5-23
Run	14	5F91-2		16	5-30
Axes Referenced	15	1.) 5F93-4		17	5-33
X Axis at Last Commanded Position	16	1.) 5F93-8		27	5-25
Y Axis at Last Commanded Position	17	1.) 5F93-9		28	5-25
Z Axis at Last Commanded Position	18	1.) 5F93-10		29	5-25
Spindle in Position	19	5F92-5		24	5-29
Spindle at Speed	33	5F91-15		18	5-29
Auto	34	5F92-15			5-30
Transfer Enable	35	5F91-14	20		5-26
Power Interrupt	36	5F91-4	19		5-30
Aux Output 1	37	5F91-7	21		5-24
Aux Output 2	38	5F91-8	22		5-24
Aux Output 3	39	5F91-9	23		5-24
Aux Output 4	40	5F91-10	24		5-24
Aux Output 5	53	5F91-11	25		5-24
Aux Output 6	54	5F91-12	26		5-24
Aux Output 7	55	5F91-13	27		5-24
Diagnostic Data Valid	56				5-27
Diagnostic Data Bit 1	57				5-27
Diagnostic Data Bit 2	58				5-27
Diagnostic Data Bit 3	59				5-27
Diagnostic Data Bit 4	60				5-27
Homed		5F91-3	18		5-23
Velocity Override Active		5F91-5			5-33
Parameter Mode		5F92-0		19	5-30
Programming Mode		5F92-1		20	5-31
X Axis at Home		5F92-2		21	5-31
Y Axis at Home		5F92-3		22	5-31
Z Axis at Home		5F92-4		23	5-31
Spindle at Home		5F92-6		25	5-29
Program Pause		5F92-7			5-31
IBS Multiplexing		5F92-8			5-36
IBS Multiplexing		5F92-9			5-36
IBS Multiplexing		5F92-10			5-36
IBS Multiplexing		5F92-11			5-36
Spindle Zero Speed		5F92-12			5-29
Rapid		5F92-13			5-31
Single Cycle		5F92-14			5-31
Aux Output 8		1.) 5F93-0	28		5-24
Aux Output 9		1.) 5F93-1	29		5-24
Aux Output 10		1.) 5F93-2	30		5-24
Aux Output 11		1.) 5F93-3	31		5-24
X Axis Referenced		1.) 5F93-5			5-32
Y Axis Referenced		1.) 5F93-6			5-32
Z Axis Referenced		1.) 5F93-7			5-33
Host Enabled		1.) 5F93-11		26	5-32
Program Not Stopped		1.) 5F93-12			5-32

Table 5-2: Output description and usage

1.) These IBS outputs are only available with IBS 2 and ***not*** IBS 1.

DEA04 Card I/O arrangement

The DEA04 provides 15 inputs and 16 outputs.

The IKS0123 cable wire colors are shown in the tables below for reference. Refer to the cable assembly drawing for complete cable assembly information.

Input Description	DEA04.x ConnectorX17 Pin #	IKS0123 Cable Wire Color	Visual TRANS Register – Bit #	CTA / BTC Input #	Specification on page
Enable Forward	1	BKGN	40 – 1	1	5-14
Auto / Manual	2	GYPK	40 – 2	2	5-14
Start	3	RDGN	40 – 3	3	5-19
Enable	4	BKYE	40 – 4	4	5-14
Forward	5	GNBU	40 – 5	5	5-15
Reverse	6	RDBU	40 – 6	6	5-15
Fault Clear	7	BNYE	40 – 7	7	5-17
Home Request	8	BNGY	40 – 8	8	5-16
Ack Input 1	9	RDWH	40 – 9	9	5-24
Ack Input 2	10	WHPK	40 – 10	10	5-24
Ack Input 3	11	BKWH	40 – 11	11	5-24
Jump **C**onditional 1	12	BNPK	40 – 12	12	5-20
Jump **C**onditional 2	13	YEWH	40 – 13	13	5-20
Jump **C**onditional 3	14	GNWH	40 – 14	14	5-20
Jump **O**n **E**vent	15	BUWH	40 – 15	15	5-20

Table 5-3: DEA04 Card Input Arrangement

Output Description	DEA04.x ConnectorX17 Pin #	IKS0123 Cable Wire Color	Visual TRANS Register – Bit #	CTA / BTC Output #	Specification on page
No Fault	16	GNGY	41 – 1	1	5-23
Ready	17	GYWH	41 – 2	2	5-23
Homed	18	WH	41 – 3	3	5-23
Power Interrupt	19	VT	41 – 4	4	5-30
Transfer Enable	20	YE	41 – 5	5	5-26
Aux Output 1	21	PK	41 – 6	6	5-24
Aux Output 2	22	BU	41 – 7	7	5-24
Aux Output 3	23	YEGY	41 – 8	8	5-24
Aux Output 4	24	GNPK	41 – 9	9	5-24
Aux Output 5	25	YEPK	41 – 10	10	5-24
Aux Output 6	26	BNBU	41 – 11	11	5-24
Aux Output 7	27	BNGN	41 – 12	12	5-24
Aux Output 8	28	YEBU	41 – 13	13	5-24
Aux Output 9	29	RDYL	41 – 14	14	5-24
Aux Output 10	30	BNRD	41 – 15	15	5-24
Aux Output 11	31	BKBN	41 – 16	16	5-24

Table 5-4: DEA04 Card Output Arrangement

DEA04 and DEA05 Card I/O arrangement

The DEA04 provides 15 inputs and 16 outputs. When the DEA05 is used along with the DEA04, it provides 15 additional inputs and 16 additional outputs for a total of 30 inputs and 32 outputs.

Input Description	DEA04.x ConnectorX17 Pin #	IKS0123 Cable Wire Color	Visual TRANS Register – Bit #	CTA / BTC Input #	Specification on page
Enable Forward	1	BKGN	40 – 1	1	5-14
Auto / Manual	2	GYPK	40 – 2	2	5-14
Start	3	RDGN	40 – 3	3	5-19
Enable	4	BKYE	40 – 4	4	5-14
Forward	5	GNBU	40 – 5	5	5-15
Reverse	6	RDBU	40 – 6	6	5-15
Fault Clear	7	BNYE	40 – 7	7	5-17
Home Request	8	BNGY	40 – 8	8	5-16
Ack Input 1	9	RDWH	40 – 9	9	5-24
Ack Input 2	10	WHPK	40 – 10	10	5-24
Ack Input 3	11	BKWH	40 – 11	11	5-24
Jump **C**onditional 1	12	BNPK	40 – 12	12	5-20
Jump **C**onditional 2	13	YEWH	40 – 13	13	5-20
Jump **C**onditional 3	14	GNWH	40 – 14	14	5-20
Jump **O**n **E**vent	15	BUWH	40 – 15	15	5-20
Input Description	**DEA05.x ConnectorX32 Pin #**	**IKS0123 Cable Wire Color**	**Visual TRANS Register – Bit #**	**CTA / BTC Input #**	**Specification on page**
Jump **C**onditional 4	1	BKGN	42 – 1	17	5-20
Jump **C**onditional 5	2	GYPK	42 – 2	18	5-20
Ack Input 4	3	RDGN	42 – 3	19	5-24
Ack Input 5	4	BKYE	42 – 4	20	5-24
Ack Input 6	5	GNBU	42 – 5	21	5-24
Ack Input 7	6	RDBU	42 – 6	22	5-24
Program Reset	7	BNYE	42 – 7	23	5-24
X Axis Jog	8	BNGY	42 – 8	24	5-18
Y Axis Jog	9	RDWH	42 – 9	25	5-18
Z Axis Jog	10	WHPK	42 – 10	26	5-18
S Axis Jog	11	BKWH	42 – 11	27	5-18
Invert Axis Jog Direction	12	BNPK	42 – 12	28	5-18
Hand	13	YEWH	42 – 13	29	5-21
Manual Spindle Enable	14	GNWH	42 – 14	30	5-14
Not Used	15	BUWH	42 – 15	31	

Table 5-5: DEA04 and DEA05 Card Input Arrangement

Output Description	DEA04.x ConnectorX17 Pin #	IKS0123 Cable Wire Color	Visual TRANS Register – Bit #	CTA / BTC Output #	Specification on page
No Fault	16	GNGY	41 – 1	1	5-23
Ready	17	GYWH	41 – 2	2	5-23
Homed	18	WH	41 – 3	3	5-23
Power Interrupt	19	VT	41 – 4	4	5-30
Transfer Enable	20	YE	41 – 5	5	5-26
Aux Output 1	21	PK	41 – 6	6	5-24
Aux Output 2	22	BU	41 – 7	7	5-24
Aux Output 3	23	YEGY	41 – 8	8	5-24
Aux Output 4	24	GNPK	41 – 9	9	5-24
Aux Output 5	25	YEPK	41 – 10	10	5-24
Aux Output 6	26	BNBU	41 – 11	11	5-24
Aux Output 7	27	BNGN	41 – 12	12	5-24
Aux Output 8	28	YEBU	41 – 13	13	5-24
Aux Output 9	29	RDYL	41 – 14	14	5-24
Aux Output 10	30	BNRD	41 – 15	15	5-24
Aux Output 11	31	BKBN	41 – 16	16	5-24
Output Description	**DEA05.x ConnectorX32 Pin #**	**IKS0123 Cable Wire Color**	**Visual TRANS Register – Bit #**	**CTA / BTC Output #**	**Specification on page**
Run	16	GNGY	43 – 1	17	5-30
Axes Referenced	17	GYWH	43 – 2	18	5-33
Spindle at Speed	18	WH	43 – 3	19	5-29
Parameter Mode	19	VT	43 – 4	20	5-30
Programming Mode	20	YE	43 – 5	21	5-31
X Axis at Home	21	PK	43 – 6	22	5-31
Y Axis at Home	22	BU	43 – 7	23	5-31
Z Axis at Home	23	YEGY	43 – 8	24	5-31
Spindle in Position	24	GNPK	43 – 9	25	5-29
Spindle at Home	25	YEPK	43 – 10	26	5-29
Host Enabled	26	BNBU	43 – 11	27	5-32
X Axis at Last Commanded Position	27	BNGN	43 – 12	28	5-25
Y Axis at Last Commanded Position	28	YEBU	43 – 13	29	5-25
Z Axis at Last Commanded Position	29	RDYL	43 – 14	30	5-25
Not Used	30	BNRD	43 – 15	31	
Not Used	31	BKBN	43 – 16	32	

Table 5-6: DEA04 and DEA05 Card Output Arrangement

DEA28 Card I/O arrangement

The DEA28 card provides 32 inputs and 24 outputs.

The cable wire colors are shown in the table below for reference. Cable IKS0159 was previously used for the DEA28. It has been replaced by IKS0186, which has a different construction of the cable insulation. The connection to the pins and the individual conductor color code is the same for both cables. Refer to the cable assembly drawing for complete cable assembly information.

Input Description	DEA28.1M Connector X72 Pin #	IKS0186 Cable Wire Color	Visual TRANS Register – Bit #	CTA / BTC Input #	Specification on page
Enable	1	WH	400 - 1	0	5-14
Enable Forward	2	BN	400 - 2	1	5-14
Auto / Manual	3	GN	400 - 3	2	5-14
Fault Clear	4	YE	400 - 4	3	5-17
Home Request	5	GY	400 - 5	4	5-16
Start	6	PK	400 - 6	5	5-19
Manual Spindle Enable	7	BU	400 - 7	6	5-14
Forward	8	RD	400 - 8	7	5-15
Reverse	9	BK	400 - 9	8	5-15
Not Used	10	VT	400 - 10	9	
Jump **O**n **E**vent	11	GY/PK	400 - 11	10	5-20
Hand	22	BU/RD	400 - 12	11	5-21
X Axis Jog	23	GN/WH	400 - 13	12	5-18
Y Axis Jog	24	BN/GN	400 - 14	13	5-18
Z Axis Jog	25	YE/WH	400 - 15	14	5-18
S Axis Jog	26	BN/YE	400 - 16	15	5-18
Invert Axis Jog Direction	27	GY/WH	401 - 1	16	5-18
Diagnostic Request LSB	28	BN/GY	401 - 2	17	5-27
Diagnostic Request MSB	29	WH/PK	401 - 3	18	5-27
Jump **C**onditional 1	30	BN/PK	401 - 4	19	5-20
Jump **C**onditional 2	31	BU/WH	401 - 5	20	5-20
Jump **C**onditional 3	32	BU/BN	401 - 6	21	5-20
Jump **C**onditional 4	43	RD/WH	401 - 7	22	5-20
Jump **C**onditional 5	44	BN/RD	401 - 8	23	5-20
Ack Input 1	45	BK/WH	401 - 9	24	5-24
Ack Input 2	46	BK/BN	401 - 10	25	5-24
Ack Input 3	47	GN/GY	401 - 11	26	5-24
Ack Input 4	48	YE/GY	401 - 12	27	5-24
Ack Input 5	49	PK/GN	401 - 13	28	5-24
Ack Input 6	50	YE/PK	401 - 14	29	5-24
Ack Input 7	51	GN/BU	401 - 15	30	5-24
Program Reset	52	BK/GN/WH	401 - 16	31	5-24

Table 5-7: DEA28 Card Input Arrangement

Output Description	DEA28.1M Connector X72 Pin #	IKS0186 Cable Wire Color	Visual TRANS Register – Bit #	CTA / BTC Output #	Specification on page
No Fault	12	YE/BU	410 - 1	0	5-23
Ready	13	RD/GN	410 - 2	1	5-23
Run	14	RD/YE	410 - 3	2	5-30
Axes Referenced	15	BK/GN	410 - 4	3	5-33
X Axis at Last Commanded Position	16	BK/YE	410 - 5	4	5-25
Y Axis at Last Commanded Position	17	BU/GY	410 - 6	5	5-25
Z Axis at Last Commanded Position	18	BU/PK	410 - 7	6	5-25
Spindle in Position	19	RD/GY	410 - 8	7	5-29
Spindle at Speed	33	BK/GY	410 - 9	8	5-29
Auto	34	BK/PK	410 - 10	9	5-30
Transfer Enable	35	BK/BU	410 - 11	10	5-26
Power Interrupt	36	BK/RD	410 - 12	11	5-30
Aux Output 1	37	BK/BN/WH	410 - 13	12	5-24
Aux Output 2	38	BK/YE/GN	410 - 14	13	5-24
Aux Output 3	39	BK/GY/PK	410 - 15	14	5-24
Aux Output 4	40	BK/RD/BU	410 - 16	15	5-24
Aux Output 5	53	BK/BN/GN	411 - 1	16	5-24
Aux Output 6	54	BK/YE/WH	411 - 2	17	5-24
Aux Output 7	55	BK/BN/YE	411 - 3	18	5-24
Diagnostic Data Valid	56	BK/GY/WH	411 - 4	19	5-27
Diagnostic Data Bit 1	57	BK/BN/GY	411 - 5	20	5-27
Diagnostic Data Bit 2	58	BK/WH/PK	411 - 6	21	5-27
Diagnostic Data Bit 3	59	BK/BN/PK	411 - 7	22	5-27
Diagnostic Data Bit 4	60	BK/BU/WH	411 - 8	23	5-27

Table 5-8: DEA28 Card Output Arrangement

Fieldbus (Interbus-S) I/O arrangement

Input Description	DBS03.1M IBS 1 or 2 Object # - Bit	Visual TRANS Register – Bit #	CTA / BTC Input #	Specification on page
Enable	5FB1-0	40 - 1	0	5-14
Enable Forward	5FB1-1	40 - 2	1	5-14
Auto / Manual	5FB1-2	40 -3	2	5-14
Fault Clear	5FB1-3	40 -4	3	5-17
Home Request	5FB1-4	40 -5	4	5-16
Start	5FB1-5	40 -6	5	5-19
Manual Spindle Enable	5FB1-6	40 -7	6	5-14
Forward	5FB1-7	40 -8	7	5-15
Reverse	5FB1-8	40 -9	8	5-15
Not Used	5FB1-9	40 -10	9	
Jump **O**n **E**vent	5FB1-10	40 -11	10	5-20
X Axis Jog plus	5FB1-11	40 -12	11	5-18
X Axis Jog minus	5FB1-12	40 -13	12	5-18
Y Axis Jog plus	5FB1-13	40 -14	13	5-18
Y Axis Jog minus	5FB1-14	40 -15	14	5-18
Z Axis Jog plus	5FB1-15	40 -16	15	5-18
Z Axis Jog minus	5FB2-0	107 - 1	16	5-18
S Axis Jog plus	5FB2-1	107 - 2	17	5-19
S Axis Jog minus	5FB2-2	107 -3	18	5-19
Jump **C**onditional 1	5FB2-3	107 -4	19	5-20
Jump **C**onditional 2	5FB2-4	107 -5	20	5-20
Jump **C**onditional 3	5FB2-5	107 -6	21	5-20
Jump **C**onditional 4	5FB2-6	107 -7	22	5-20
Jump **C**onditional 5	5FB2-7	107 -8	23	5-20
Ack Input 1	5FB2-8	107 -9	24	5-24
Ack Input 2	5FB2-9	107 -10	25	5-24
Ack Input 3	5FB2-10	107 -11	26	5-24
Ack Input 4	5FB2-11	107 -12	27	5-24
Ack Input 5	5FB2-12	107 -13	28	5-24
Ack Input 6	5FB2-13	107 -14	29	5-24
Ack Input 7	5FB2-14	107 -15	30	5-24
Program Reset	5FB2-15	107 -16	31	5-24
Parameter Mode	5FB3-0	108 - 1	32	5-21
Programming Mode	5FB3-1	108 - 2	33	5-22
Hand	5FB3-2	108 -3	34	5-21
Continuous Mode	5FB3-3	108 -4	35	5-22
Single Block Mode	5FB3-4	108 -5	36	5-22
Velocity Override 1	5FB3-5	108 -6	37	5-22
Velocity Override 2	5FB3-6	108 -7	38	5-22
IBS Multiplexing	5FB3-7	108 -8	39	5-34
IBS Multiplexing	5FB3-8	108 -9	40	5-34
IBS Multiplexing	5FB3-9	108 -10	41	5-34
IBS Multiplexing	5FB3-10	108 -11	42	5-34
Not used	5FB3-11	108 -12	43	
Comm Header Enable	5FB3-12	108 -13	44	5-21
Cycle Start	5FB3-13	108 -14	45	5-21
Cycle Stop	5FB3-14	108 -15	46	5-21
Rapid	5FB3-15	108 -16	47	5-22

Table 5-9: Fieldbus (Interbus-S) Input Arrangement

Output Description	DBS03.1M IBS 1 or 2 Object # - Bit	Visual TRANS Register – Bit #	CTA / BTC Output #	Specification on page
No Fault	5F91-0	41 - 1	0	5-23
Ready	5F91-1	41 - 2	1	5-23
Run	5F91-2	41 -3	2	5-30
Homed	5F91-3	41 -4	3	5-23
Power Interrupt	5F91-4	41 -5	4	5-30
Velocity Override Active	5F91-5	41 -6	5	5-33
Not Used	5F91-5	41 -7	6	
Aux Output 1	5F91-7	41 -8	7	5-24
Aux Output 2	5F91-8	41 -9	8	5-24
Aux Output 3	5F91-9	41 -10	9	5-24
Aux Output 4	5F91-10	41 -11	10	5-24
Aux Output 5	5F91-11	41 -12	11	5-24
Aux Output 6	5F91-12	41 -13	12	5-24
Aux Output 7	5F91-13	41 -14	13	5-24
Transfer Enable	5F91-14	41 -15	14	5-26
Spindle at Speed	5F91-15	41 -16	15	5-29
Parameter Mode	5F92-0	109 - 1	16	5-30
Programming Mode	5F92-1	109 - 2	17	5-31
X Axis at Home	5F92-2	109 -3	18	5-31
Y Axis at Home	5F92-3	109 -4	19	5-31
Z Axis at Home	5F92-4	109 -5	20	5-31
Spindle in Position	5F92-5	109 -6	21	5-29
Spindle at Home	5F92-6	109 -7	22	5-29
Program Pause	5F92-7	109 -8	23	5-31
IBS Multiplexing	5F92-8	109 -9	24	5-36
IBS Multiplexing	5F92-9	109 -10	25	5-36
IBS Multiplexing	5F92-10	109 -11	26	5-36
IBS Multiplexing	5F92-11	109 -12	27	5-36
Spindle Zero Speed	5F92-12	109 -13	28	5-29
Rapid	5F92-13	109 -14	29	5-31
Single Cycle	5F92-14	109 -15	30	5-31
Auto	5F92-15	109 -16	31	5-30
Output Description	**DBS03.1M IBS 2 only Object # - Bit**	**Visual TRANS Register – Bit #**	**CTA / BTC Output #**	**Specification on page**
Aux Output 8	5F93-0	43 - 1	32	5-24
Aux Output 9	5F93-1	43 - 2	33	5-24
Aux Output 10	5F93-2	43 -3	34	5-24
Aux Output 11	5F93-3	43 -4	35	5-24
Axes Referenced	5F93-4	43 -5	36	5-33
X Axis Referenced	5F93-5	43 -6	37	5-32
Y Axis Referenced	5F93-6	43 -7	38	5-32
Z Axis Referenced	5F93-7	43 -8	39	5-33
X Axis at Last Commanded Position	5F93-8	43 -9	40	5-25
Y Axis at Last Commanded Position	5F93-9	43 -10	41	5-25
Z Axis at Last Commanded Position	5F93-10	43 -11	42	5-25
Host Enabled	5F93-11	43 -12	43	5-32
Program Not Stopped	5F93-12	43 -13	44	5-32
Not used	5F93-13	43 -14	45	
Not used	5F93-14	43 -15	46	
Not used	5F93-15	43 -16	47	

Table 5-10: Fieldbus (Interbus-S) Output Arrangement

I/O Reference Cards

The following tables can be copied, cut out, and folded to make pocket reference cards for use when viewing the I/O status display on the CTA 10 or BTC 06. The I/O status display is reached by pressing the right arrow key while at the main display screen of the HMI.

DEA04 or DEA04 & 05

The DEA04 card provides 15 inputs and 16 outputs.

When the DEA05 card is used along with the DEA04, it provides 15 additional inputs and 16 additional outputs for a total of 30 inputs and 32 outputs.

DEA05 OUTPUTS 17-32 Register #43	Bit In Reg.	DEA05 INPUTS 17-31 Register #42		DEA04 OUTPUTS 1-16 Register #41	Bit In Reg.	DEA04 INPUTS 1-15 Register #40	DEA04 & 05 I/O TRANS 01-D 06VRS As displayed on CTA / BTC
17 Run	1	17 Cond Jump 4		1 No Fault	1	1 Enable-Forward	
18 AxesReferencd	2	18 Cond Jump 5		2 Ready	2	2 Auto	
19 Sp @CMD	3	19 Ack Input 4		3 All axes home	3	3 Start/Restart	
20 Param mode	4	20 Ack Input 5		4 PowerInterrupt	4	4 Enable	
21 Program mode	5	21 Ack Input 6		5 TransferEnable	5	5 Forward	
22 X axis @home	6	22 Ack Input 7		6 Aux output 1	6	6 Reverse	
23 Y axis @home	7	23 Program Reset		7 Aux output 2	7	7 Fault clear	
24 Z axis @home	8	24 X Axis Jog		8 Aux output 3	8	8 Homing request	
25 Sp in Positin	9	25 Y Axis Jog		9 Aux output 4	9	9 Ack Input 1	
26 Sp @home	10	26 Z Axis Jog		10 Aux output 5	10	10 Ack Input 2	
27 Host Enabled	11	27 S Axis Jog		11 Aux output 6	11	11 Ack Input 3	
28 X @LastCmdPos	12	28 Invert JogDir		12 Aux output 7	12	12 Cond jump 1	
29 Y @LastCmdPos	13	29 Hand Mode		13 Aux output 8	13	13 Cond jump 2	
30 Z @LastCmdPos	14	30 ManSpindEnabl		14 Aux output 9	14	14 Cond jump 3	
31 Not used	15	31 Not used		15 Aux output 10	15	15 Jump on event	
32 Not used	16	(no input)		16 Aux output 11	16	(no input)	

Table 5-11: DEA04 & DEA05 I/O Reference Card

DEA28

The DEA28 card provides 32 inputs and 24 outputs.

DEA28 OUTPUTS 16-23 Register #411	Bit In Reg.	DEA28 INPUTS 16-31 Register #401		DEA28 OUTPUTS 0-15 Register #410	Bit In Reg.	DEA28 INPUTS 0-15 Register #400	DEA28 I/O TRANS 01-D 06VRS As displayed on CTA / BTC
16 Aux output 5	1	16 Invrt jog dir		0 No fault	1	0 Enable	
17 Aux output 6	2	17 Diag Request1		1 Ready	2	1 Enable Forward	
18 Aux output 7	3	18 Diag Request2		2 Run	3	2 Auto/Manual	
19 DiagDataValid	4	19 Cond Jump 1		3 All axes @home	4	3 Fault Clear	
20 DiagData Bit1	5	20 Cond Jump 2		4 X @LastCommPos	5	4 Homing Request	
21 DiagData Bit2	6	21 Cond Jump 3		5 Y @LastCommPos	6	5 Start/Restart	
22 DiagData Bit3	7	22 Cond Jump 4		6 Z @LastCommPos	7	6 Man Spind Enab	
23 DiagData Bit4	8	23 Cond Jump 5		7 Spindle in Pos	8	7 Forward	
(no output)	9	24 Ack input 1		8 Spindl @CMD sp	9	8 Reverse	
(no output)	10	25 Ack input 2		9 Auto Mode	10	9 Not used	
(no output)	11	26 Ack input 3		10 Transf enable	11	10 Jump on Event	
(no output)	12	27 Ack input 4		11 PowerInterupt	12	11 Hand Mode	
(no output)	13	28 Ack input 5		12 Aux output 1	13	12 X axis jog	
(no output)	14	29 Ack input 6		13 Aux output 2	14	13 Y axis jog	
(no output)	15	30 Ack input 7		14 Aux output 3	15	14 Z axis jog	
(no output)	16	31 Program Reset		15 Aux output 4	16	15 S axis jog	

Table 5-12: DEA28 I/O Reference Card

Interbus-S

The Interbus-S configuration IBS 2 provides 48 inputs to the TRANS 01-D and 48 outputs from the TRANS 01-D transferred on the fieldbus.

Configuration IBS 1 provides 48 inputs and 32 outputs.

Both provide multiplexed status data in the cyclic data telegram and ASCII protocol message objects in the non-cyclic (PCP) channel.

Interbus-S I/O TRANS 01-D 06VRS
As displayed on CTA / BTC

IBS 1 or 2 INPUTS 0-15 Register #40 Object #5FB1	Bit In Reg.	IBS 1 or 2 OUTPUTS 0-15 Register #41 Object #5F91
0 Enable	1	0 No Fault
1 Enable-Forward	2	1 Ready
2 Auto	3	2 Run
3 Fault Clear	4	3 All axes @Home
4 Home request	5	4 Power Interupt
5 Start/Restart	6	5 Vel OverrideOn
6 Man sp enable	7	6 Not used
7 Forward	8	7 Aux output 1
8 Reverse	9	8 Aux output 2
9 Not used	10	9 Aux output 3
10 Jump on event	11	10 Aux output 4
11 X axis jog+	12	11 Aux output 5
12 X axis jog-	13	12 Aux output 6
13 Y axis jog+	14	13 Aux output 7
14 Y axis jog-	15	14 TransfrEnable
15 Z axis jog+	16	15 Sp @CMD speed

IBS 1 or 2 INPUTS 16-31 Register #107 Object #5FB2	Bit In Reg.	IBS 1 or 2 OUTPUTS 16-31 Register #109 Object #5F92
16 Z axis jog-	1	16 Param mode
17 S axis jog+	2	17 Program mode
18 S axis jog-	3	18 X axis @home
19 Cond Jump 1	4	19 Y axis @home
20 Cond Jump 2	5	20 Z axis @home
21 Cond Jump 3	6	21 Sp In Pos
22 Cond Jump 4	7	22 Spindle @home
23 Cond Jump 5	8	23 Prog paused
24 Ack Input 1	9	24 IBS multiplex
25 Ack Input 2	10	25 IBS multiplex
26 Ack Input 3	11	26 IBS multiplex
27 Ack Input 4	12	27 IBS multiplex
28 Ack Input 5	13	28 Sp @ 0 speed
29 Ack Input 6	14	29 Rapid jog sel
30 Ack Input 7	15	30 Single cycle
31 Program Reset	16	31 Auto mode sel

IBS 1 or 2 INPUTS 32-47 Register #108 Object #5FB3	Bit In Reg.	IBS 2 ONLY OUTPUTS 32-47 Register #43 Object #5F93
32 Param mode	1	32 Aux Output 8
33 Program mode	2	33 Aux Output 9
34 Hand mode	3	34 Aux Output 10
35 Cont cycle	4	35 Aux Output 11
36 Single block	5	36 AxesReferencd
37 Vel Override1	6	37 X Referenced
38 Vel Override2	7	38 Y Referenced
39 IBS multiplex	8	39 Z Referenced
40 IBS multiplex	9	40 X @LastComPos
41 IBS multiplex	10	41 Y @LastComPos
42 IBS multiplex	11	42 Z @LastComPos
43 Not used	12	43 Host Enabled
44 Comm Header	13	44 Prog NotStopd
45 Cycle start	14	45 Not used
46 Cycle stop	15	46 Not used
47 Rapid jog	16	47 Not used

Cyclic Data Telegram Format		
PLC (output) to TRANS01-D (input)		
Object	**Word**	**TRANS data & size**
5FB1	0	Register 40 – 1 word
5FB2	1	Register 107 – 1 word
5FB3	2	Register 108 – 1 word
<dummy>	3	none - 1 word
<dummy>	4	none - 1 word
TRANS01-D (output) to PLC (input)		
Object	**Word**	**TRANS data & size**
5F91	0	Register 41 – 1 word
5F92	1	Register 109 – 1 word
5F93	2	Register 43 – 1 word
5F10	3&4	mux data – 2 words

Non-Cyclic (PCP channel) Data Object Definitions	
(Used to exchange CLC ASCII protocol messages)	
Object	**Data Exchanged**
5E70	16 byte message
5E71	32 byte message
5E72	64 byte message
5E73	128 byte message

Multiplex Data Response		
(Output from TRANS) (PLC Input)		
Axis Selected		
Object 5F92 Bit 11	**12**	**Axis**
0	0	X
0	1	Y
1	0	Z
1	1	S
Data Selected		
Object 5F92 Bit 10	**9**	**Data**
0	0	Diagnostics
0	1	Position
1	0	Speed
1	1	Torque

Multiplex Data Request		
(PLC Output) (Input to TRANS)		
Axis Selection		
Object 5FB3 Bit 8	**9**	**Axis**
0	0	X
0	1	Y
1	0	Z
1	1	S
Data Selection		
Object 5FB3 Bit 10	**11**	**Data**
0	0	Diagnostics
0	1	Position
1	0	Speed
1	1	Torque

Table 5-13: Fieldbus (Interbus-S) I/O Reference Card

Rexroth Indramat

5.4 Enables

There are two enable signals which must be provided by the machine builder to enable operation of the TRANS 01-D. They are provided on the parallel Cycle Interface or by the I/O Network (when the proper bits in parameter P02 are set).

Enable

This signal is required to enable operation of the TRANS 01-D. Loss of the Enable signal interrupts both Automatic and Manual operation. The Enable line does not reset the program in any way. Enable is a master-release whose purpose is to ensure that motion of the unit can occur only when the machine is in the correct state, such as a workpiece in correct position, guards closed, etc.

Note: No servo motion can occur unless the enable signal is set high.

Enable-Forward

This signal is required to enable operation of the Forward cycle in both Manual and Automatic Modes. Loss of this signal stops execution of the Forward program. This signal is ignored in Homing/Reverse programs.

Manual Spindle Enable

When the TRANS 01-D is in Automatic Mode, program execution can only occur if the connected spindle controller is operational and returning the Spindle Ready signal. However, during manual mode, the spindle will only run, and its diagnostic signals interrogated, if this signal is high. This allows operation of the slide in manual mode without running the spindle, necessary during startup, retooling, or in the case of a defective spindle drive train. This signal is normally connected to the line controller (e.g., programmable controller), or a manual operator device.

5.5 Operator Interface

Operator manual controls are available through a parallel operator interface. The machine builder can wire these signals to selector switches and pushbuttons at the transfer station. The normal programmed movements may be executed manually from this station, and they may be made only when the necessary enables are present. The following signals are provided:

Automatic / Manual

With Automatic selected (input high), the TRANS 01-D will be in Automatic Mode and can be operated only by control signals provided by the Line Control. This is the normal mode of operation for the TRANS 01-D, where it performs a single program cycle each time the Line Control issues a Start signal.

Manual control at the unit Operator Station is possible only when the TRANS 01-D is in manual mode and TRANS 01-D diagnostic checking has not detected any interruptions. Should the TRANS 01-D refuse to operate, it will diagnose and display the reason.

If the TRANS 01-D is in Automatic Mode and is executing a part program, bringing this input low will force the TRANS 01-D into Manual Mode within the conditions set up in parameter P05. The TRANS 01-D may be switched back into Automatic Mode and restarted by the Start signal provided that no hand jogging operations have been performed or any soft or hard faults have occurred. (If hand operations have been performed, a restart in Automatic Mode is not possible).

Forward

Generally wired to a push-button. The TRANS 01-D must be in MANUAL mode and the Enable-Forward signal must be present to enable this button. While this button is held depressed, the TRANS 01-D will perform the programmed operation (beginning at block 000), following the programmed forward profile. Releasing the push-button stops the movement. Pressing the button again continues the operation.

When the control completes execution of a block containing a reverse vector of JR000, which indicates the end of the forward profile (full depth), program execution halts and this input will be ignored. At this point, the Reverse input should be activated to perform the return (reverse) profile.

When first pressed, the FORWARD button will be effective only when the slide has been referenced and the correct program and zero references are present.

Reverse

This signal has increased functionality when the TRANS 01-D is in “Auto” mode or “Manual” mode.

Manual Mode

With “Auto” low and “Home Request” high any subsequent “Reverse” signal being brought high will cause the TRANS 01-D to execute the Reverse program stored in N195.

If “Auto” is low and “Home Request” low and “Reverse” is brought high the TRANS 01-D will execute the currently stored reverse vector. Normal program operation for this signal requires the TRANS 01-D to be in Manual mode (“Auto” input low and Single Cycle selected). When the “Reverse” input is held high (and “Enable” input also high) the TRANS 01-D will jump to the current reverse vector block and continue execution from that point onwards until it encounters a ‘Jump and Stop’ – JS000. Bringing the Reverse signal low stops the part program execution and returning the signal high again allows the program execution to continue.

If the NC part program is halted on the Reverse Vector JR000 (e.g., N020) i.e. end of Forward cycle, by bringing the ‘Forward’ input low and the ‘Reverse’ input high the TRANS 01-D will begin execution of the next sequential block (e.g., N021).

If the ‘Forward’ input is brought low during the execution of the NC part program and the ‘Reverse’ input brought high, before the JR000 has been reached, the TRANS 01-D will continue program execution from the NC part programming block that has been specified as the current Reverse Vector.

Forward program

N000 JR195

N001 G01 G90 G61

N019 G01 G90 G61 X10

N020 G01 G90 G61 Z10 M0000000 JR000

Reverse program

N021 G00 G90G61 X0 Z0

N022 M0000011 JS000

Automatic Mode: With “Auto” high and “Reverse” high any subsequent “Home Request” signal being brought high will cause the TRANS 01-D to execute the Reverse program stored in N195.

If “Auto” is high and “Reverse” low and “Home Request” is brought high the TRANS 01-D will execute the currently stored reverse vector.

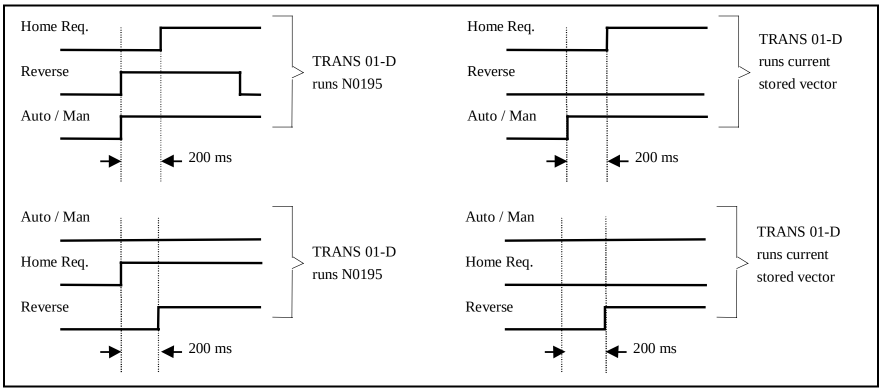


Fig. 5-1: Reverse timing diagrams

Home Request

In Automatic Mode, receipt of this signal causes the unit to immediately execute the program beginning at the current reverse vector or block 195, if no reverse vector is specified. If an automatic cycle is being executed, it is interrupted.

Homing also performs the Emergency Home function. The unit is homed per the user-entered reverse program and can perform various functions such as tool retraction during program execution.

Conditions for acceptance of the Homing signal are:

- Station is in Automatic mode.
- Enable signal is present on the Cycle Interface.

5.6 TRANS 01-D Reset Inputs

The Fault Clear and Program Reset inputs are used in combination to activate one of three functions. The following table defines how the two inputs are used to activate each function.

Function	Program Reset	Fault Clear
None	0	0
Fault Clear	0	1
Program Reset	1	0
System Reset	1	1

Table 5-14:TRANS 01-D I/O functions

Fault Clear

When a fault occurs in the TRANS 01-D system, this input is used to clear the fault and get the TRANS 01-D back to a clear state. This signal only clears the fault condition in the TRANS 01-D. If the conditions that originally caused the fault are still present when the fault is cleared, the fault may reoccur.

Program Reset

Activating this function sets the forward program pointer to block N000. This function is immediately activated when the Program Reset function is detected. The Ready output may be used to detect the completion of the Program Reset function (refer to Manual Ready parameter description below). This function is enabled under the following conditions:

1. The TRANS 01-D is either in Manual or Automatic mode.
2. The Run output is off, i.e., NC program execution is either stopped or paused.

Manual Mode Ready Parameter

This parameter is part of the System Options within Process parameter P06. The Manual Ready parameter changes the conditions in which the Ready output is set on in manual mode. When the Manual Ready parameter is <u>disabled</u>, the Ready output will not come on in manual mode. It will only come on in Automatic and only if all the following conditions are high:

1. The TRANS 01-D is in Manual Mode.
2. NC Program execution state is Stopped.
3. All Axes have established home positions (i.e., all drives are zero referenced).
4. The current NC Program execution direction is Forward.
5. The current NC Program block number is N000.
6. The !Fault output is on (i.e., no fault condition).

When the Manual Mode Ready parameter is <u>enabled</u>, the Ready can be on in Manual. The Ready output will be on in Manual Mode if the conditions 2 through 6 above are met.

System Reset

Activating this function results in a full system reset, which is equivalent to power cycling the control system. The System Reset function is enabled under precisely the same conditions as Program Reset (they must be valid before a Program Reset can be successfully attempted):

1. The TRANS 01-D is in either Manual or Automatic mode.
2. The Run output is off (i.e., NC program execution is either stopped or paused).

This function is activated when a transition to the System Reset function is detected and held for at least 200 ms. The transition from either None, Fault Clear or Program Reset to System Reset must be <u>after</u> the enable conditions are satisfied. With this system reset, the following will take place inside the TRANS 01-D:

1. The program pointer will be reset to Forward, block N000.
2. The current Reverse Vector will be reset to N195.
3. The Jump on Event flag will be reset to off.
4. Default modes will be restored (G90, G61, G36, etc.).

5. If a “Feed to a Positive Stop” move is in progress, it will be aborted and the Bi-Polar Torque will be reset to its value before the G75 block.
6. If the axis is disabled using the G21 program command, it will be re-enabled. (Ab to AF)
7. Incremental type axis will have to be re-referenced.
8. All Auxiliary Outputs will be turned off.
9. All timers will be reset to 0 (Dwell Timers and JW timers, etc.)
10. All currently valid tool offsets will be cleared.
11. The value stored in the External Tool Offset Registers will be saved in case it is needed.

5.7 Jogging Inputs

X Axis Jog, Y Axis Jog, Z Axis Jog, S Axis Jog

Invert Axis Jog Direction

DEA28 or DEA05

When the TRANS 01-D is set to Hand mode with the Enable input high, the user has the ability to jog the specified axis or spindle. With the DEA28 or DEA05 I/O cards, this is done with 5 inputs – four to select the axis and one to control direction. The axis designations on DEA28.1M pins 23 to 26 or DEA05 pins 8 to 10 specify the axis to be jogged. The direction is determined by the Jogging Direction parameter (Aa11 for the axes, AS09 for the spindle). If the user wants to reverse the jogging direction, the jogging request must first be stopped. This can be accomplished by setting either Enable (Pin 1) or the individual axis jog request (Pins 23 - 26) low. Change the state of DEA28 Pin 27 or DEA05 pin 12 (Invert Axis Jog Direction) for the desired jogging direction. Finally, restore whichever input was used above to stop jogging to high.

Example

To jog the X-axis using DEA28, first put the TRANS 01-D into Hand Mode with the Enable input High. Set X-Axis Jog request (Pin 23) High and the X-axis will begin jogging in the positive direction. Jogging the X-axis in the negative direction requires 3 steps:

1. Set Enable low.
2. Set Invert Axis Jog Direction high.
3. Set Enable high.

This procedure can be duplicated for all other axes. Jogging is limited to one axis at a time.

Note: These inputs will have no effect if the CTA10-1 is enabled. Refer to "Enabling the CTA10-1" in section 4.3

X, Y, Z Axes Jog - Plus and Minus

Interbus-S

With the Interbus-S I/O card, jogging of the axes is done with 6 inputs – a separate input for each direction of each axis. When the jog plus input for any configured SERVO axes goes high, that axis will begin to jog in the direction specified in Axes parameter Aa11 (Directions – Jogging). If the jog plus input is brought low and the jog minus input is set high, the axis will jog in the opposite direction.

Note: This input will have no effect if the CTA10-1 is enabled. Refer to "Enabling the CTA10-1" in section 4.3

The TRANS 01-D needs to be in ‘Hand’ mode and the 'Enable’ input needs to be high for any configured SERVO axis to move.

S Axis Jog - Plus and Minus

Interbus-S

With the Interbus-S I/O card, jogging of the spindle is done with 2 inputs – a separate input for each direction. When the ‘jog plus’ input for the S (Spindle) axis goes high, the S axis will begin to jog in the direction specified in Axis parameter AS09 (Directions – Jogging). If the ‘jog plus’ input is brought low and the ‘jog minus’ input is set high, the S axis will jog in the opposite direction.

Note: This input will have no effect if the CTA10-1 is enabled. Refer to "Enabling the CTA10-1" in section 4.3

The TRANS 01-D must be in ‘Hand’ mode and the 'Enable’ and 'Manual Spindle Enable' inputs need to be high for the S axis to move.

5.8 Cycle Interface Inputs

For operation of the transfer line through discrete I/O or Network control, the TRANS 01-D requires the signals described below. The machine builder will wire these signals to the Line Control as required by the overall system design.

When an I/O Network is present, the proper bits in parameter P02 must be set to enable the TRANS 01-D to accept the Forward Enable, Restart, Enable, Start, Homing, etc. from the Network Interface.

The signals on the Cycle Interface are:

Start

This signal initiates the Automatic cycle, operating the TRANS 01-D in Single Cycle Mode, assuming that the following conditions are present:

- Selector switch at the Operator Station is on Automatic.
- Enable and Enable Forward signals are present on the Cycle Interface.
- All acknowledgments agree with their associated auxiliary functions.

The TRANS 01-D ensures that all start conditions are present and issues a Ready signal on the Cycle Interface.

Start is a high-level-sensitive signal, but its receipt is latched (stored) in the TRANS 01-D control, assuming the above conditions are present.

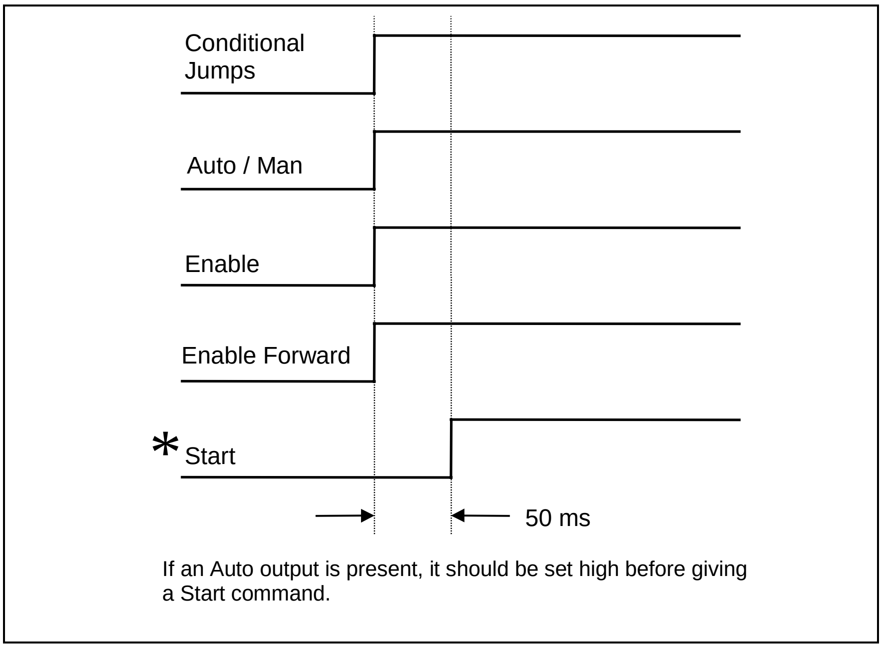


Fig. 5-2: Start Input Condition

Conditional Jump Inputs

Jump Conditional 1-5

Five inputs for conditional jumps are provided on the TRANS 01-D interface. Up to 32 different program jumps can be performed using the 5 bits of the conditional jump control signal. These could be used to call up various part programs or reverse programs stored in the TRANS 01-D. These lines could be wired to a selector switch or tied to the Line Control.

Note: If the system uses an I/O Network, parameter P02 specifies from where these conditional jump inputs will be accepted.

Jump on Event

Certain applications require that the current operating program be interrupted by an external signal or event and from that point continue in a different manner. The ’Jump on Event’ signal is level sensitive. The signal must be at least 50 milliseconds long in order to ensure that the TRANS 01-D will recognize it.

This input signal will be ignored if:

- a REVERSE program is in operation
- Hand mode on the TRANS 01-D has been selected
- a JUMP ON EVENT program is being currently processed
- a START command has not been given

If the ’Jump on Event’ signal has been received at the beginning of the FORWARD program, the ’Jump on Event’ program will take place immediately.

5.9 Remaining TRANS 01-D Inputs

Hand

When this input goes high, the TRANS 01-D is set to ’Hand’ mode (see display on CTA10-1), and with ‘enable’ high allows the X, Y and Z axis to be jogged manually. To jog the spindle ‘Manual Spindle Enable’ also needs to be high.

If the TRANS 01-D has the ‘Auto’ input high (i.e., in Automatic mode), the ‘Hand’ input is ignored.

Note: This input will have no effect if the CTA10-1 is enabled. Refer to "Enabling the CTA10-1" in section 4.3

Parameter Mode

When this input goes high, the TRANS 01-D is set to ‘Parameter’ mode (see display on CTA-10). All the drives should now read ‘P2’. Parameter mode allows changing of the TRANS 01-D Axes and Process parameter values.

If the TRANS 01-D has the ‘Auto’ input high (i.e., in Automatic mode) or ‘Prog’ input high, the ‘Parameter’ input is ignored.

Note: This input will have no effect if the CTA10-1 is enabled. Refer to "Enabling the CTA10-1" in section 4.3

Cycle Start

When this input goes high, the TRANS 01-D runs the stored NC part program in ‘Continuous‘ or ‘Block by Block’ mode. The TRANS 01-D has to be in one of the two selected modes (‘Continuous‘ or ‘Block by Block‘) before the ‘Cycle Start’ input can be brought high.

Note: This input will have no effect if the CTA10-1 is enabled. Refer to "Enabling the CTA10-1" in section 4.3

Cycle Stop

When this input goes high, the TRANS 01-D stops the stored NC part program that is running in ‘Continuous’ or ‘Block by Block‘ mode. The TRANS 01-D has to be in one of the two selected modes (‘Continuous‘ or ‘Block by Block‘) and the ‘Cycle Start’ input must be high before the ‘Cycle Stop’ has an impact.

Note: This input will have no effect if the CTA10-1 is enabled. Refer to "Enabling the CTA10-1" in section 4.3

Comm Header Enable

When this input is low, the TRANS 01-D uses “SIS” protocol with a 7-byte header for messages transferred through the non-cyclic fieldbus communication channel. When this input is high, the TRANS 01-D TRANS 01-D uses ASCII protocol with no header for messages transferred through the non-cyclic fieldbus communication channel. If the PLC is configured to use non-cyclic communication (“PCP channel” in Interbus-S), this input should be set on by the PLC to avoid communication errors.

Rapid

Setting this input high allows the TRANS 01-D to jog any of the configured X, Y or Z axes at the rapid jog speed rate specified in the respective Axis parameter Aa10. This input will have no effect unless all axes are referenced.

Note: This input will have no effect if the CTA10-1 is enabled. Refer to "Enabling the CTA10-1" in section 4.3

Programming Mode

When this input goes high, the TRANS 01-D enters programming mode and the ‘Prog’ output goes high. It is now possible to enter and change existing NC part programs. This input will have no effect if:

- The ‘Auto’ or the ‘Parameter’ input is high
- The CTA10-1 is enabled

Note: This input will have no effect if the CTA10-1 is enabled. Refer to "Enabling the CTA10-1" in section 4.3

Continuous Mode

When this input goes high, the TRANS 01-D will be in ‘Continuous’ mode. This allows the user to control execution of the program using the ‘Cycle Start’ & ‘Cycle Stop’ commands.

The ‘Auto’ input needs to be low before this option can be selected.

Note: This input will have no effect if the CTA10-1 is enabled. Refer to "Enabling the CTA10-1" in section 4.3

Single Block Mode

When this input goes high, the TRANS 01-D will be in ‘Block by Block’ mode. This allows the user to control execution of the program using the ‘Cycle Start’ & ‘Cycle Stop’ commands. Each time the ‘Cycle Start’ is pressed, the TRANS 01-D executes one NC part programming block. The only exception is when the TRANS 01-D is running a series of G62 (without lag) commands. In this case, ‘Cycle Start’ needs to be pressed as many times as there are G62s in the programming sequence and then motion begins.

The ‘Auto’ input needs to be low before this option can be selected.

Note: This input will have no effect if the CTA10-1 is enabled. Refer to "Enabling the CTA10-1" in section 4.3

Velocity Override 1 & 2

The fieldbus I/O configuration provides a way for the PLC to override programmed velocity. This may be useful during checkout of a new program or to limit speeds during recovery moves. These two inputs can be used to reduce the velocity of all motion. An output “Velocity Override Active” is provided to indicate to the PLC when the override value is not at 100%. The following table defines the input and output bits.

% of Velocity used	Velocity Override 2 (input)	Velocity Override 1 (input)	Velocity Override Active (output)
100%	0	0	0
50%	0	1	1
25%	1	0	1
10%	1	1	1

Table 5-15: Velocity Override Inputs and Output

The Velocity Override feature is available in TRANS 01-D firmware release 06V39 and later. These inputs were unused ("reserved") in releases prior to 06V39.

5.10 Cycle Interface Outputs

Ready

The TRANS 01-D issues the Ready signal to indicate that all conditions are correct for the automatic cycle. Ready will continue to be present on the Cycle Interface as long as all conditions for an automatic cycle remain acceptable. These conditions are:

- Automatic Mode selected (connector X17, pin 2 high.) or Manual mode ready parameter P06 is enabled in Manual mode.
- Axis normalized (homing performed since power-up or clear).
- Block 000 selected.

When the Ready line is high, a Start signal from the Line Control will be accepted by the TRANS 01-D, as long as the Enables are also present.

Homed

The Home output indicates that all enabled slides are in a position where the tool is clear of the workpiece, therefore a part transfer is possible. It is also related to the Home Limit switch, when used, and indicates that the slide is at or behind the Home position. The following conditions must also be satisfied.

- Reference position is known (homing done since last reset).

The Home outputs are designed to show the user the status of each axis after homing. If only one axis and a Spindle are used, the output on Pin #18 or Interbus-S Object 5F91 will be used. If multiple axes are configured, the output on Pin 18 or Interbus-S Object 5F91 will be an all axis at Home output. If the user requires additional outputs to determine when each axis is at Home, the outputs in Interbus-S Object 5F92 can be used.

Note: The Spindle At Home output is not used in the logic for the Home output.

No Fault

In both Automatic and Manual modes, loss of the Fault output is indicated when the TRANS 01-D has diagnosed a malfunction. This signal indicates that the respective unit is not operational. When a fault occurs, an operator must determine and resolve the problem utilizing the diagnostic display capabilities of the TRANS 01-D, then reset the TRANS 01-D, homing the axis if necessary in order to bring it to Ready status once more.

5.11 Auxiliary and Acknowledgment Functions

Auxiliary Outputs

Auxiliary Outputs 1-11

These programmable output signals are provided by the TRANS 01-D and can be tailored to the user's needs for any additional status signals, such as "Full Depth", etc. They are also used for clamping, spindle control, tool expansion, etc.

Discrete Outputs are +24 Vdc, 100 mA per output, short circuit protected, optically isolated from internal circuitry.

Note: Each auxiliary function may have an associated acknowledgment input. Refer to Table 5-16: TRANS 01-D I/O options for associated acknowledgments.

When an auxiliary function is turned on or off, an acknowledgment is required, because the control issues the output, then waits for the acknowledgment before continuing with its cycle.

Acknowledgment Inputs

Acknowledgment Inputs 1-7

Each of the acknowledgment inputs is associated with a corresponding auxiliary function. *Refer to table below for available number of acknowledgments per selected I/O type.* When that function line is turned on or off under program control, an acknowledgment of that action can be required to be returned to the TRANS 01-D for programmed operations to continue. Once an acknowledgment is issued, it must remain unchanged in that state until the corresponding auxiliary function output is changed. Otherwise, a soft fault will occur.

Note: If the system uses a Line Control Network, parameter P02 specifies from where the acknowledgments will be accepted. From the TRANS 01-D interface (DEA cards) or accept the acknowledgment inputs only from the I/O Bus.

I/O Type	Auxiliary Outputs	Acknowledgment Inputs	Conditional Jumps
DEA4	11	3	3
DEA4&5	11	7	5
DEA28	7	7	5
IBS *I*	7	7	5
IBS *II*	11	7	5

Table 5-16: TRANS 01-D I/O options

Line Control Interface Guidelines

Required Sequence of Auxiliary Function Timing:

1. Turn on an auxiliary function output.
2. TRANS 01-D waits until an acknowledgment is received.
3. Turn auxiliary function output off.
4. TRANS 01-D waits until an acknowledgment is received, then continues its processing.

Note: If the state of an auxiliary output is changed, then the change must be acknowledged. A change in an acknowledgment must always be preceded by a change in the auxiliary output.

Example The system moves at rapid feedrate into position to cut a part and clamps the workpiece during the rapid movement to save time. Prior to cutting, an auxiliary output is issued to verify that the clamp is down. An acknowledgment will allow cutting to proceed. Note that if the acknowledgment is issued as soon as the clamp is down, it may be diagnosed as a fault. It must not be given until the TRANS 01-D requests it (via auxiliary output) and the clamp is down.

In your programmable controller, we suggest use of a contact that is closed when an auxiliary output is issued. By placing this contact in the ladder rung where the associated acknowledgment is generated, you enable the acknowledgment by closing a contact in series with it. Thus, the acknowledgment never comes on before it is requested and goes off immediately when the auxiliary output is dropped.

Of course, this may not apply in all cases. If necessary, you can bridge the auxiliary output contact to prevent the acknowledgment from turning off until the proper conditions have occurred.

Axis at Last Programmed Position Outputs

When the TRANS 01-D is in Program, Manual, or Automatic mode, the Axis at Last Programmed Position outputs will be ON (TRUE) if the present feedback position of the associated axis falls within the Position Window of the previous target position of the axis, otherwise the output will be OFF (FALSE). The Position Window of the axis (as defined in CTA10-1 axis parameter Ax17A) is considered when the feedback position of the axis is compared to the previous target position.

The Axis at Last Programmed Position outputs for each axis are updated continuously such that if a commanded move on the X-axis from 20 to 50 units were interrupted before completion, the system was brought into Hand mode, and the X-axis was jogged back to 20 units, the X-axis in Position output would be turned ON.

The Axis at Last Programmed Position output for an axis will be off under any of the following conditions:

- The associated axis is not configured.
- The TRANS 01-D is not in Program, Manual, or Automatic mode.
- The associated axis has not successfully completed a commanded move since the TRANS 01-D last booted or since it last exited Parameter mode.

NOTE: Prior to firmware release 06T15, these outputs had a different functionality – Axis in Motion. The control set would the Axis In Motion outputs by comparing each drive's actual velocity with the drive's Standstill Window (S-0-0124). If the actual velocity was less than the Standstill Window, the In Motion output of that axis was set low, otherwise it was set high. The Axis In Motion outputs were only updated when the

TRANS 01-D is in Manual, Automatic or Program mode. When in parameter, the outputs are unconditionally set low.

Transfer Enable

A *Transfer Enable Range High Limit* parameter and a *Transfer Enable Range Low Limit* parameter (TRANS 01-D Process parameter P10) exists for each linear axis (i.e., the X, Y, and Z-axes). An error check is performed on these parameters when the TRANS 01-D is exiting parameter mode; if the positive limit is strictly less than the negative limit, an error is generated and the TRANS 01-D is prevented from exiting parameter mode.

The *Transfer Range* is disabled for a given axis when both of its *Transfer Enable* limits are set to zero, otherwise the *Transfer Range* is enabled for that axis.

Only axes which meet all of the following criteria will be included in the evaluation of the *Transfer Enable* output. In what follows, axes that meet all of the following criteria are called *valid for consideration*.

- Axis is X, Y, or Z (not the spindle).
- Axis is enabled (via P02, the Axis Configuration parameter).
- Axis is configured for linear (mm or inch units), rather than rotary motion.
- The *Transfer Range* is enabled for the axis.

The *Transfer Enable* output will be true when ALL of the following criteria are met, otherwise the output will be false…

- The TRANS 01-D is in either Manual or Automatic mode.
- The TRANS 01-D is <u>not</u> in a fault condition (i.e., the No Fault output is True).
- At least one axis is valid for consideration.
- **All** axes which are valid for consideration are referenced.
- The feedback position of **all** axes which are valid for consideration is greater than or equal to the *Transfer Enable Range Low Limit* and less than or equal to the *Transfer Enable Range High Limit.* (The range is inclusive of the limits).

5.12 Diagnostic Outputs

The System diagnostic messages for the TRANS 01-D are available to the user through the input and output lines of the DEA28. Input Pins 28 & 29 are used to request the diagnostic data. Output pins 57-60 are used for outputting the diagnostic data. Output pin 56 is used as a Data Valid output to signal to the Line Control that the requested diagnostic data is valid and on the output lines.

The diagnostic numbers are Binary numbers broken up into three 4-bit nibbles. This gives the user the ability to obtain 4096 diagnostic messages. The user will use inputs 28 & 29 to request the nibble number (1,2, or 3). When this request is received by the TRANS 01-D, it will display this nibble on outputs 57-60. When the requested information is ready on the output lines, output pin 56 will go high signaling that the requested data is available on the four output lines. To obtain the complete diagnostic number, the user must request all three nibbles. Once the three nibbles are received by the Line Control, it can determine what diagnostic number it received. By referring to a look up table of our system diagnostic message numbers and associated text, the Line Control can displaying the diagnostic message.

Diagnostic Request Inputs (DEA28 Pins 28 & 29)

These inputs are used to request one of three nibbles (4 bits) of the diagnostic number. The Diagnostic Request inputs are read in a binary fashion. Nibble 1 contains the **L**east **S**ignificant **B**its and Nibble 3 contains the **M**ost **S**ignificant **B**its. The table below shows the relationship between the Request inputs and the Data outputs.

Request	Pin 29 (MSB)	Pin 28 (LSB)
Nibble #1	0	1
Nibble #2	1	0
Nibble #3	1	1

Table 5-17: True Table Diagnostic Request

The TRANS 01-D latches the System diagnostic message number when the Request transitions from zero to nonzero. Hence, to read a new message number, the Line Control must set the Request to zero for a time duration of no less than one TRANS 01-D I/O cycle time (i.e., currently, 50 milliseconds).

Diagnostic Data (DEA28 Pins 57-60)

The requested diagnostic data is output on these lines one nibble (4 bits) at a time. The requested data remain on these lines until the Request is changed.

Diagnostic Data Valid (DEA28 Pin 56):

When the requested data is output on the data lines, this output goes high to signal to the Line Control that the requested data is available. After requesting a new nibble, the Line Control must latch the Data Output. The Data Output lines can be read only after a false to true transition of Data Valid is detected. If the status of the Diagnostic Request inputs changes, this output goes low for approximately 80 milliseconds, until the newly requested data is available. This allows the Line Control to detect the false to true transition of Data Valid.

The following timing diagram shows the procedure that must be used for requesting diagnostic data:

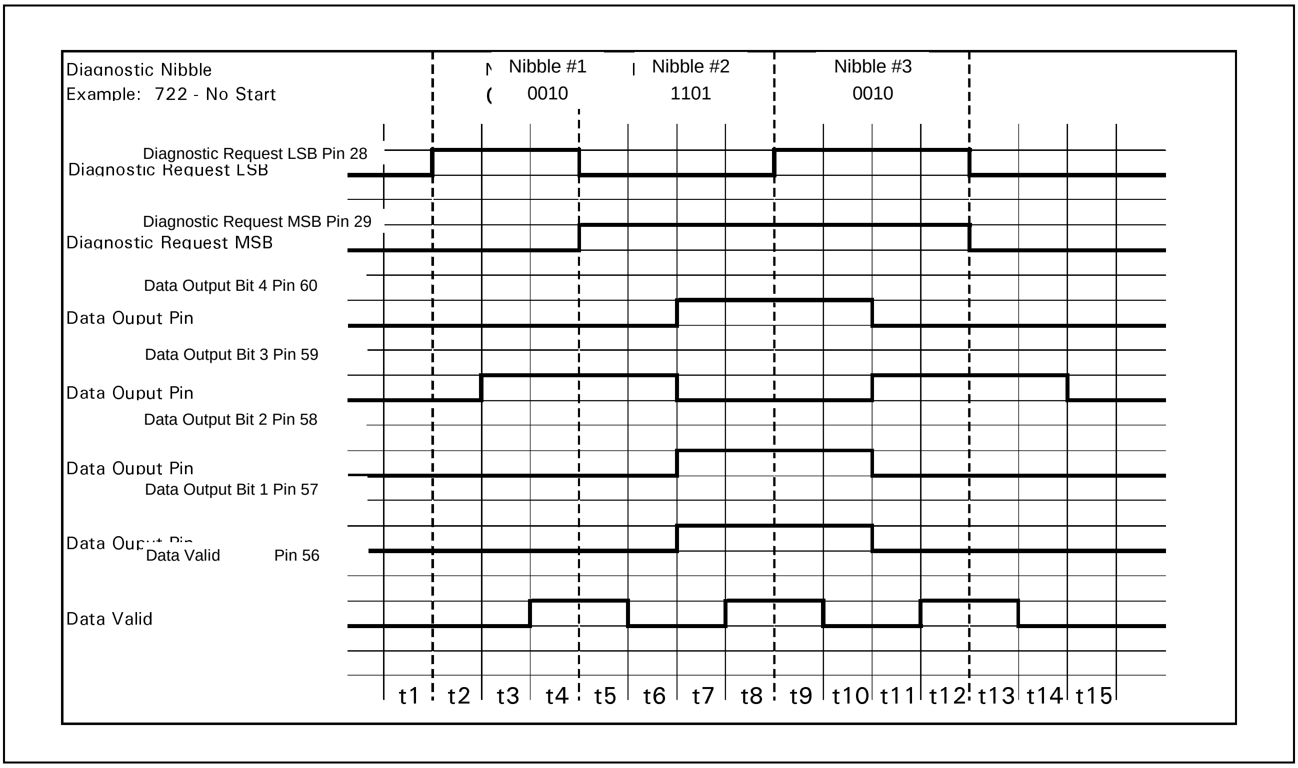


Fig. 5-3: Timing diagram for Diagnostic Data

Timing Diagram explanation:

t1 = Assume all data lines are low to begin transmission

t2 = Line Control sets Request lines for 1st nibble.

t3 = Diagnostic data for 1st nibble is output on pins 57-60 (0010)

t4 = Data Valid output goes high. Line Control detects false to true transition of Data Valid and reads Diagnostic Data.

t5 = Line Control sets Request lines for 2nd nibble.

t6 = TRANS 01-D detects the change in the Diagnostic Request lines and sets Data Valid low for approx. 80 ms.

t7 = Diagnostic data for 2nd nibble is output on pins 57-60.

t8 = Data Valid output goes high. Line Control detects false to true transition of Data Valid and reads Diagnostic Data.

t9 = Line Control set Requests lines for 3rd nibble.

t10 = TRANS 01-D detects the change in the Diagnostic Request lines and sets Data Valid low for approx. 80 ms.

t11 = Diagnostic data for 3rd nibble is output on pins 57-60 (0010)

t12 = Data Valid output goes high. Line Control detects false to true transition of Data Valid and reads Diagnostic Data.

t13 = Line Control sets all Requests lines False to signal end of transmission.

t14 = TRANS 01-D detects the change in the Diagnostic Request lines and sets Data Valid low. Ready to begin another transmission.

All transmissions are based upon the timing of the individual devices used. In this way, the speed of the transmission is dependent on the speed of the TRANS 01-D, the Line Control and the medium used to transmit the data. Handshaking is used to assure all devices read and request data correctly.

5.13 Spindle Outputs

Spindle Zero Speed:

Output is on, if **all** the following conditions are true:

1. Either Position or Velocity mode (i.e., any spindle mode).
2. Auto or Manual mode (i.e., not Parameter or Program mode).
3. The absolute value of the spindle feedback speed is less than or equal to the Standstill Window (S-0-0124).

Spindle at Speed

Output is on, if **all** the following conditions are true:

1. Either Position or Velocity mode (i.e., any spindle mode).
2. Auto or Manual mode (i.e., not Parameter or Program mode).
3. The absolute value of the speed error (i.e., Command speed - actual speed) is less than or equal to 25% of the Programmed Velocity (A-0-0110).

Spindle at Home

Output is on, if **all** the following conditions are true:

1. Either Position or Velocity mode (i.e., any spindle mode).
2. Auto or Manual mode (i.e., not Parameter or Program mode).
3. The spindle feedback position is within the Position Window parameter (S-0-0057) about the zero position
4. The Spindle at Zero Speed output is true.

Spindle in Position

Output is on, if **all** the following conditions are true:

1. Either Position or Velocity mode (i.e., any spindle mode).
2. Auto or Manual mode (i.e., not Parameter or Program mode).
3. The In-Position status bit is on in the spindle Axis Status register (i.e., #34).
4. The Spindle at Zero Speed output is true.

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5.14 Remaining TRANS 01-D Outputs

Run

This output signal goes high in either Automatic or Manual mode. It indicates that the TRANS 01-D is actually 'running' or executing through a NC part program.

In Auto mode, 'Run' goes high once the TRANS 01-D has received a 'Start' signal and has not executed a 'JS000' – jump and stop to zero command.

In Manual mode, 'Run' goes high when either 'Forward' or 'Reverse' are high and the TRANS 01-D is executing the NC part program. Setting either of these signals low will cause 'Run' to go low and the 'Program Paused' output to go high.

Auto

When the TRANS 01-D has successfully received an 'Auto' input, this output goes high indicating that the TRANS 01-D is in 'Auto' mode awaiting a 'Start' command.

Power Interrupt

This is a safety feature of the TRANS 01-D. If while the TRANS 01-D is executing a NC part program in either Manual or Auto mode (the 'Run' or 'Paused' outputs will be high), then power is dropped to the system (e.g., lighting storm.) Once power has been restored to the TRANS 01-D, this 'Power Interrupt' output will be high. The TRANS 01-D has to execute a Reverse program (Default or stored) before any forward program can be executed.

If in Manual mode, the 'Reverse' input needs to be supplied to the TRANS 01-D.

If in Auto mode, the 'Home Request' needs to be supplied to the TRANS 01-D.

Executing a successful reverse program causes the Power Interrupt output to go low, after which a 'Forward' program can be successfully run.

Parameter Mode

When the TRANS 01-D has successfully received a 'Parameter' input, this output goes high indicating that the TRANS 01-D is in 'Parameter' mode. TRANS 01-D axes and process parameters can now be successfully edited or archived.

Programming Mode

When the TRANS 01-D has successfully received a ‘Programming’ input, this output goes high indicating that the TRANS 01-D is in ‘Programming’ mode. Downloading or editing of TRANS 01-D NC part programs can now be successfully completed.

X Axis at Home

When the TRANS 01-D has successfully completed a G74 homing procedure, this output goes high indicating that the axis is either:

At the physical home location

Or

the home switch input is high but the X axis need not necessarily be at the physical home position.

Y Axis at Home

When the TRANS 01-D has successfully completed a G74 homing procedure, this output goes high indicating that the axis is either:

At the physical home location

Or

the home switch input is high but the Y axis need not necessarily be at the physical home position.

Z Axis at Home

When the TRANS 01-D has successfully completed a G74 homing procedure, this output goes high indicating that the axis is either:

At the physical home location

Or

the home switch input is high but the Z axis need not necessarily be at the physical home position.

Program Paused

The ‘program paused’ output goes high when the TRANS 01-D is in Manual mode and is executing either the Forward or Reverse program and the respective ‘Forward’ or ‘Reverse’ input to the TRANS 01-D goes low. This output also goes high when a fault occurs during program execution in Automatic or manual modes.

Rapid

When the TRANS 01-D has successfully received a ‘Rapid’ input, this ‘Rapid’ output goes high indicating that the selected axis being jogged is jogged at the programmed feedrate of axis parameter Aa10.

Single Cycle

The ‘single cycle' output goes high when the TRANS 01-D is in Manual mode and has successfully received a ‘single cycle’ input. Program

execution can now occur when either the Forward or Reverse inputs are brought high and the ‘Enable’ and ‘Enable Forward’ inputs are also high.

Host Enabled

The ‘Host Enabled’ output goes high when the CTA10-1 has been enabled as option 6 within the Menu screen. States that can be controlled by both the CTA and the interface card inputs (for example, ‘Jog’, ‘Program’ and ‘Parameter’ inputs on the Interbus-S card) are ignored when applied through the interface card and are only active through the CTA10-1. Refer to on page for details of which functions are switched for each I/O configuration. The following conditions must be met to change the state of Host Enabled:

- Not in Auto Mode (Auto Mode Output must be off)
- Not program paused (Program Paused must be off)
- Program not Active (Program Not Stopped must be low)
- Not in Hand mode
- Not in Program mode
- Not in Parameter mode
- Manual Spindle Enable not on (Manual Spindle Enable input off)

Program Not Stopped

The ‘Program Not Stopped’ output is brought high when the TRANS 01-D is in either in a Run or Paused state (‘Run’ or ‘Paused’ states are high).

X Axis Referenced

This output comes high when the TRANS 01-D has successfully performed a homing procedure (G74) on the X axis. This output will remain high as long as the X-axis is referenced. The reference will be lost if the servo drive drops to ‘P2’ parameter mode or if power is lost to the machine. If the X-axis has a Multi-turn encoder this output is high only after the Set Absolute Measuring Point procedure has been executed on the X axis and the drive has been cycled through initialization from ‘P2’. The output is always off when the system is in parameter mode and returns to its previous state when the system comes out of parameter mode.

Y Axis Referenced

This output comes high when the TRANS 01-D has successfully performed a homing procedure (G74) on the Y axis. This output will remain high as long as the Y-axis is referenced. The reference will be lost if the servo drive drops to ‘P2’ parameter mode or if power is lost to the machine. If the Y-axis has a Multi-turn encoder this output is high only after the Set Absolute Measuring Point procedure has been executed on the Y axis and the drive has been cycled through initialization from ‘P2’. The output is always off when the system is in parameter mode and returns to its previous state when the system comes out of parameter mode.

Z Axis Referenced

This output comes high when the TRANS 01-D has successfully performed a homing procedure (G74) on the Z axis. This output will remain high as long as the Z-axis is referenced. The reference will be lost if the servo drive drops to ‘P2’ parameter mode or if power is lost to the machine. If the Z-axis has a Multi-turn encoder this output is high only after the Set Absolute Measuring Point procedure has been executed on the Z axis and the drive has been cycled through initialization from ‘P2’. The output is always off when the system is in parameter mode and returns to its previous state when the system comes out of parameter mode.

Axes Referenced

This output goes high when ALL the axes that are configured in CTA10-1 Process parameter P02 have their corresponding ‘Axes Referenced’ output high. This output is effectively the logical ‘ANDing’ of the ‘axis referenced’ outputs of all the axes configured within the TRANS 01-D system.

Velocity Override Active

This output indicates to the PLC when the override value controlled by the Velocity Override Inputs 1 & 2 is not at 100%. The output is off when the override is at 100% and on at any other value. Refer to Table 5-15 on page 5-23 for details.

The Velocity Override feature is available in TRANS 01-D firmware release 06V39 and later. This output was unused (“reserved”) in releases prior to 06V39.

5.15 I/O Network Signals

Input Signals

When using the TRANS 01-D with an I/O network, the signals usually handled by the CTA-10 can become available to the user through the I/O network. By using these signals, the user can operate the TRANS 01-D in Automatic, Manual or Hand mode by the use of the available signals.

Input Object # 5FB3

Bit #	Description	Explanation
0	*Parameter Mode*	*When this input is high, the TRANS 01-D will go into Parameter Mode.*
1	*Programming Mode*	*When this input is high, the TRANS 01-D will go into Programming Mode.*
2	*Hand Mode*	*When this input is high, the TRANS 01-D will go into Hand Mode.*
3	*Continuous Cycle*	*When operating in Hand Mode, this input will cause the TRANS 01-D to run the program continuously, even if a Jump and Stop is programmed.*
4	*Single Block*	*When operating in Hand Mode, this input will cause the TRANS 01-D to run the program one block at a time. Each successive block is executed after a new Cycle Start (bit #13) is issued.*
5	*Velocity Override 1*	*Together with the next bit, this selects the value of velocity override.*
6	*Velocity Override 2*	*Together with the previous bit, this selects the value of velocity override*
7	**Multiplexing**	**See Table 5-20 for description**
8	**Multiplexing**	**See Table 5-20 for description**
9	**Multiplexing**	**See Table 5-20 for description**
10	**Multiplexing**	**See Table 5-20 for description**
11	*Reserved*	*Not used at this time.*
12	*Communication Header Enable*	*Set this input to a 1 to disable the Indramat Communications Protocol header.*
13	*Cycle Start*	*This input starts the program cycle in Hand Mode*
14	*Cycle Stop*	*This input stops the program cycle in Hand Mode*
15	*Rapid Jog*	*Not enabled at this time.*

Table 5-18: Input Signals

Output Signals

Output Object # 5F92

Bit #	Description	Explanation
0	*Parameter Mode*	*This output will go high when the TRANS 01-D is in Parameter Mode*
1	*Programming Mode*	*This output will go high when the TRANS 01-D is in Programming Mode*
2	*X Axis at Home*	*Signifies that the X axis has been referenced (Homed) and is on the Home Switch.*
3	*Y Axis at Home*	*Signifies that the Y axis has been referenced (Homed) and is on the Home Switch.*
4	*Z Axis at Home*	*Signifies that the Z axis has been referenced (Homed) and is on the Home Switch.*
5	*Spindle in Position*	*When using a Spindle, this output will notify the user that the Spindle has reached its commanded position.*
6	*Spindle at Home*	*Signifies that the S axis has been referenced (Homed) and is at the Home position.*
7	*Program Paused* *Immediate Stop*	*This output will be high when the TRANS 01-D program is paused or in an Immediate Stop condition.*
8	**Multiplexing**	**See Table 5-21 for description**
9	**Multiplexing**	**See Table 5-21 for description**
10	**Multiplexing**	**See Table 5-21 for description**
11	**Multiplexing**	**See Table 5-21 for description**
12	*Spindle at 0 Speed*	*This output will be high when the Spindle axis has reached 0 speed.*
13	*Rapid Jog*	*Not enabled at this time.*
14	*Single Cycle*	*This output will go high when the TRANS 01-D is in Hand Mode running the program in Single Cycle Mode.*
15	*Automatic Mode*	*This output will be high whenever the TRANS 01-D is in Automatic Mode.*

Table 5-19: Output Signals

Multiplexing

The TRANS 01-D gives the user the ability to receive Position, Speed, Torque and Diagnostic data through the I/O network, if the I/O network used can support this data. By setting up the respective I/O bits, the information requested can be sent out to a register designated by the I/O bus for further processing.

Input Object # 5FB3

Axis	Bit #7	Bit #8		Information	Bit #9	Bit #10
X	0	0		Diagnostics	0	0
Y	0	1		Position	0	1
Z	1	0		Speed	1	0
S	1	1		Torque	1	1

Table 5-20: Multiplexed Input Signals

Output Object # 5F92

Axis	Bit #10	Bit #11		Information	Bit #9	Bit #8
X	0	0		Diagnostics	0	0
Y	0	1		Position	0	1
Z	1	0		Speed	1	0
S	1	1		Torque	1	1

Table 5-21: Multiplexed Output Signals

How to read the above tables:

The first two bits (7,8 and 10,11) determine the axis.

The second two bits (9,10 and 9,8) determine the Information

For Example, looking at Table 5-20, the following is true:

Bit #7 = 0
Bit #8 = 0 — X axis is selected

Bit #9 = 0
Bit #10 = 1 — Information on Position

In this example, diagnostic data on X-axis positioning will be received by the TRANS 01-D.

Note: The outputs that show the status of the multiplexing are written directly to the fieldbus module. They are not updated in the output register (Register 109) and therefore are NOT updated on the I/O status display of the CTA 10 / BTC 06 HMI. In normal operation, these signals will be rapidly cycling from one setting to another as different values are multiplexed into the PLC so they change too quickly for troubleshooting from the HMI display.

5.16 DSS SERCOS Card I/O

The TRANS 01-D system includes an Emergency Stop circuit for protection of both the equipment and operating personnel through the DSS 1.3 card in the servo drive.

It is important to connect pin 6 of X12 directly with no interruption in the circuit. This is necessary to ensure that the TRANS 01-D will always detect when an Emergency Stop condition exists.

The reason the Emergency Stop circuit is wired is so that the TRANS 01-D can

1) detect when an E-Stop condition has occurred on the machine, and

2) determine and display the appropriate diagnostic.

Emergency Stop

Connector - X12 on DSS 1.3

Pins - E6

Status - Normally closed

Type - Inputs to Digital Drive through SERCOS (DSS 1.3) card.

This signal is normally supplied by the machine builder, depending on the emergency stop design for the system. If this line opens, the servo drive will shut down using the shutdown configuration specified in the drive parameters and the display will show “E5” on DIAX02 drives or “F434” (Emergency-Stop) on DIAX03/04 drives. If this input is not provided, the machine builder must wire pin 6 to +24 volts.

Note: **See the DDS Drive Manual for a full description of the parameter P-0-0007 (Error Reaction Mode).**

Primary Overtravel Limit Switches

Connector	X12 on DSS module
Pin	E2 - Positive Overtravel limit
Pin	E3 - Negative Overtravel limit
Status	Normally open
Type	Input to DSS module

Table 5-22: Primary Overtravel Limit Switch Signals

Two hardware Overtravel limit switch inputs are provided on the DSS SERCOS card plugged into the U1 slot of the servo drive. If desired, the machine builder will wire these to physical travel limit switches on the machine. This may be desirable, because the software travel limits are not active until a homing cycle is performed. Prior to that time, the axis could be manually jogged past the software limits. These inputs are active-high. If the user does not want to use them, no connection needs to be made to these inputs.

Home Limit Switch

Connector	X12 on DSS module
Pin	E1
Status	Normally open
Type	Input to DSS module

Table 5-23: Home Limit Switch Signals

This switch is closed when the slide is physically at the Home position. Because the TRANS 01-D performs time-critical monitoring of this switch, it must be wired directly to the input, not through other logic (i.e., PLC, level shifters, etc.).

6 Diagnostics and Monitoring

This section provides an explanation of the diagnostic messages a user may encounter while running the TRANS 01-D with a CLC-D card. This section lists and explains these messages in two categories:

CLC-D Diagnostic Messages**:** inform the user about the status and functioning of the system hardware components.

TRANS 01-D-Specific Diagnostic Messages**:** inform the user about the status, configuration and functioning of a running TRANS 01-D program.

There are also error codes for problems within the CTA10-1 hardware. These are not passed from the CLC-D like those described above. They are created in the CTA10-1. The error codes and descriptions are in section 6.3.

6.1 CLC-D Diagnostic Messages

The CLC provides three types of diagnostic messages, each with an identifying code number:

- Status Messages (001-199)
- Warning Messages (201-399)
- Shutdown Messages (400 - 599)

A second error code is often included within the primary error message.

- "X" indicates a hexadecimal error code
- "D" indicates a decimal error code

The Host can request the currently active diagnostic message for the CLC system and for each user task. In addition, any parameters pertaining to Drive Diagnostics can be accessed through drive service channel (Dx.x) parameters. Refer to the Drive manual for descriptions of drive diagnostics.

See the ***Parameters*** section for more detailed descriptions of the CLC System and Task parameters. For example:

- Parameter C-0-0122: CLC Card Diagnostic Message
- Parameter C-0-0123: CLC Card Diagnostic Code.
- Parameter C-0-0124: CLC Card Extended Diagnostics.
- Parameter T-s-0122: Task Diagnostic Message (where s = 1, 2, 3 or 4 for Task A - D)
- Parameter S-x-0095: SERCOS Drive Diagnostic Message (where x = 1 - 4 for Drive 1 - 4)

Status Messages (001-199)

A Status Message indicates the normal operating status of an axis, task, or the system when there are no errors. A change in status that generates a new status message overwrites the previous message. No user acknowledgment is required for a change in a status message.

Code	Description
001 Initializing System	The CLC is initializing the executive firmware, the SERCOS ring, and other devices at power-up or exit from parameter mode.
002 Parameter Mode	The CLC is in parameter mode, and the drives are in Phase 2.
003 Initializing Drives	SERCOS has been reconfigured and the ring is being initialized.
004 System is Ready	The system has been initialized and is ready for operation.
005 Manual Mode	All four user program tasks are in manual mode.
006 Automatic Mode: ABCD	The user program tasks indicated at the end of the message are in automatic mode, and the rest are in manual mode. For example, "Automatic Mode: B" indicates that only Task B is in automatic mode.
007 Program Running: ABCD	The user program tasks indicated at the end of the message are running, and the rest are not running or are single-stepping.
008 Single-Stepping: ABCD	The user program tasks indicated at the end of the message are in single-step mode. The other tasks are not running.
009 Select Parameter Mode to Continue	An error during system initialization occurred and was cleared, but the error condition was not corrected. Switch into Parameter Mode to continue. The prompt to go to Parameter Mode assumes that the system cannot initialize because it is not properly configured for the hardware that was found during initialization. It is possible that the configuration in the parameters is correct but some other problem causes the failure to initialize including: • drive cannot initialize its parameters because it cannot communicate with the motor mounted feedback (for example, if the feedback cable is missing or damaged). • TRANS 01-D cannot initialize communication with the drive because the drive did not initialize due to hardware failure or missing drive program module • TRANS 01-D cannot initialize SERCOS communication with the drive due to a broken fiber optic cable or some other hardware failure, or drive is not properly configured (for example, address switch is not properly set). If the system had been operating properly prior to appearance of this message so that it is likely that the parameters are correctly configured, check the diagnostic indicators on the drive for problems that prevent sending more precise diagnostic information from the drive to the TRANS 01-D. Refer to the drive documentation for information on diagnostic codes.
010 Breakpoint Reached: ABCD	The user tasks indicated at the end of the message have reached a user program breakpoint, and the rest of the tasks are not running.

Warning Messages (201-399)

Warning messages are issued when an improper system condition exists. The condition is important enough to be brought to an operator's immediate attention, but not critical enough to shut down the system. However, a warning may be a notification of an impending shutdown condition. Warnings typically allow normal system operation to continue.

A warning sets the error bit associated with the affected task or the system and displays the warning message. Once issued, the error condition must be corrected and acknowledged to the system. The user acknowledges and clears a warning with a low-to-high transition of the Clear All Errors bit of the CLC's System Control Register.

After a warning condition has been corrected and acknowledged, the user program can be resumed at the point where the error occurred. In SERCOS, warnings are Class 2 Diagnostics.

Warning messages can be cleared by correcting the warning condition, or by setting the CLC's clear error input.

Code	Description
200	
201 Invalid jog type or axis selected	This message is issued before a coordinated I/O jog when an invalid type or axis is selected. The selected axis cannot continue to jog in the specified direction because the travel limit (set in Axis Parameter Aa06) has been exceeded. Jog the axis in the opposite direction or change the travel limit in parameter Aa06.
202 Drive *xx* is not ready	This message is issued before a coordinated I/O jog when a drive is not enabled.
203 Power Lost During Program	This function is not currently implemented.
204 SERCOS Ring was disconnected	The SERCOS ring was disconnected before a shutdown error was cleared. The ring is now initialized. To continue, activate the clear input. This message allows detection of an intermittent break in the fiber optic ring.
205 Parameter transfer warning in Task *yy*	There is an error in the parameter transfer instruction. This indicates a warning condition that does not shut down the task. The parameter format, parameter number, or stored value may be invalid. A communication error message is displayed in the diagnostic message for the task (A-D) in which the error occurred (T-0-0122). Information on the actual parameter number that caused the error is provided in extended diagnostics (C-0-0124).
206 Battery is low: replace it soon	A low voltage on the RAM backup battery has been detected at power-up or initialization from parameter mode. Replace the battery to prevent any loss of data.
207 Axis *zz* position limit reached	The negative or positive travel limit of axis D was reached, preventing a jog from occurring.

Shutdown Messages (400 - 599)

A Shutdown is issued in an emergency situation or when the system or drives cannot operate correctly. During a shutdown, the CLC switches the user program tasks into manual mode, decelerates all motion to zero velocity, and sets the error bit in the status register.

If the shutdown condition results from an E-stop or DDS-2 drive shutdown condition, the CLC also disables the drives, disabling motor torque and engaging the brake.

A low to high transition on the Clear All Errors bit in the System Control Register will clear a shutdown. The CLC automatically sends a 'Reset Class 1 Diagnostics' command to each drive that has an error.

Code	Description
400 Emergency Stop	The Emergency Stop input is active (low). The E-Stop circuit has been opened due to activation of the E-Stop push button or external logic. All drives on the ring are disabled. Release the E-Stop button or correct the error condition.
401 SERCOS Controller Error: DD	The SERCOS communications controller has indicated an error on the SERCOS ring. Check the fiber optic connections, the addresses set on the drives, and the drive configuration.
402 SERCOS Config. Error: see ext. diag. or SERCOS Interface Error: XXXX (versions before 01.20)	An error in the SERCOS service channel has occurred when the CLC was initializing the timing and scaling parameters. The extended diagnostics (C1.124) gives a description of the error. If the extended diagnostic indicates a timing error or data limit error, check the amount of data or drives on the ring and the minimum cycle time parameter. Otherwise, check the fiber optic connections, the addresses set on the drives, and drive firmware versions.
403 System Error	This error is not issued in current CLC versions and is reserved for future use.
404 Invalid Switch into Phase D	The SERCOS communications controller did not allow a phase switch. Check if power is applied to the drives and if the fiber optic connections and the drive addresses are correct. If drive parameters were just downloaded, switch back into parameter mode to reinitialize the interface. If the above conditions are O.K., the SERCOS interface board may be faulty. **Note**: This error is issued only in versions that do not use the SERCOS ASIC (firmware versions less than 01.20).
405 Phase D: Drive did not respond	A time-out in the SERCOS ring has occurred when the CLC was initializing timing and scaling parameters. Check the fiber optic connections, the addresses set on the drives, and the drive firmware versions. This distinguishes a communication error from an actual phase switch error.
406 System Error	This error is not issued in current CLC versions and is reserved for future use.
407 Drive D Phase 3 Switch Error	The SERCOS phase 3 switch command failed for the drive indicated. This usually indicates that configuration parameters for the drive are invalid or have not been saved. Check the Drive Status message (parameter Dx.95) for drive 'D' for a description of the error. If the Drive Status indicates that parameters are invalid or lost, display the Phase 2 error parameter list for Drive 'D'. Switch into parameter mode and change the invalid parameters or download a valid parameter file to the drive. If the drive is not communicating, check the connections and the addresses. If drive parameters were just downloaded, switch back into parameter mode to reinitialize the interface.
408 SERCOS Controller is in test mode	The Indramat DAS2 SERCOS Controller is in test mode. Set the mode switch on the front of the board to a position where this error does not occur. *Note:* This error is not issued in versions that use the SERCOS ASIC.

Code	Description
409 SERCOS Disconnect Error	The SERCOS fiber optic ring was disconnected or the drives were powered down while in Phase 3 or 4. A more descriptive message will be displayed in the extended diagnostics (C1.124 - *Indicates the first drive in which the drive data failed*).
410 System Error	This error is not issued in current CLC versions and is reserved for future use.
411 Drive D Phase 4 Switch Error	The SERCOS phase 4 switch command failed for the drive indicated. This usually indicates that configuration parameters for the drive are invalid or have not been saved. Check the Drive Status message (parameter Dx.95) for drive 'D' for a description of the error. If the Drive Status indicates that parameters are invalid or lost, display the Phase 3 error parameter list for Drive 'D'. Switch into parameter mode and change the invalid parameters or download a valid parameter file to the drive. If the Drive Status indicates that there is a feedback error, voltage error, or other hardware error; correct the problem and switch into and out of parameter mode to reinitialize the interface.
412 No drives were found on ring	No drives were found when the CLC initialized the SERCOS ring to Phase 1. Check the addresses set on the drives, in the CLC program, and in the CLC parameters. Also, check that power is applied to the drives and the fiber optic connections are correct.
413 I-O board was not found	The selected I-O board was not found on the internal drive VME bus. The correct I-O device must be enabled and the address selected on the device must match the CLC parameter. Check CTA10-1 process parameter P02 to ensure that the correct I-O board is selected on the correct axis.
414 Parameters were lost	CLC System, Task, and Axis parameters were lost, and defaults have been loaded. The RAM backup battery has failed or was not connected, or an internal system error or new software version has corrupted the memory.
415 Drive D was not found	A drive (D) that is used in a program or selected in the system parameters was not found on the SERCOS ring. Check the fiber optic connections, the address switches on the drives, and the user program and parameters.
416 Invalid Instruction at XXXX	An invalid user program instruction was found by the CLC during compilation. Discharge the RAM by removing the battery for 20 minutes. Re-load the NC part program and parameters, then power off and back on. If the system still does not work, contact INDRAMAT.
417 SYSTEM ERROR: pSOS #XXXX	An internal CLC operating system error has occurred. Contact Indramat Service for assistance.
418 No program is active	No active user program was found on the CLC during initialization. Download and activate a program from the user interface, then clear the error.
419 Invalid Program File	A checksum or file format error was found in the active program file. Recompile the program from the PC and download it again. If the error still occurs, call Indramat Service for assistance.
420 Drive *xx* Shutdown Error	The drive has issued a shutdown error, which disables motion. Check the SERCOS Drive Status message (parameter Dx.95) for a description of this error. Or use the UP or DOWN arrow on the CTA / BTC HMI to view the X-Axis, Y-Axis, Z-Axis, or S-Axis diagnostic number and description. Refer to the drive manual for more information.
421 User Program Stack Overflow	The subroutine call stack for a user program task has overflowed. Check the program for the following conditions: - there is not a return for every subroutine call - a subroutine is calling itself - program flow has caused multiple returns - more than 256 subroutines are nested. See the ***task error bit*** for each task to find out which task has this error.

Code	Description
422 Parameter transfer error in Task *yy*	There is an error in the parameter transfer instruction. The parameter format, parameter number, or stored value may be invalid. A communication error message is displayed in the diagnostic message for the task (A-D) in which the error occurred (T-0-0122). Information on the actual parameter number that caused the error is provided in extended diagnostics (C-0-0124).
423 Unimplemented Instruction	The instruction is not implemented in this version. Recompile the program without this instruction indicated by the current instruction pointer or update the CLC firmware or PC software.
424 System Error	This error is not issued in current CLC versions and is reserved for future use.
425 Instruction Error: see Task A diag.	An error has occurred in a user program instruction. A more specific message is displayed in the diagnostic message for the task (A-D) in which the error occurred (T-0-0122). This error usually applies to coordinated motion instructions. To see the various Task and Axis diagnostics on the CTA / BTC press the UP or DOWN arrows. One possible cause of “425 Instruction Error: See Task C diag” is a software travel limit. In this case, pressing the UP arrow to reach the Task C diagnostic displays the message “Target pos. exceeds travel”. This indicates that the target position of a programmed move is beyond the limit set in parameters. The move cannot be beyond a point 2 times the position window (set in parameter Aa17A) away from the software travel limit (set in parameter Aa06).
426 Drive *xx* is not ready	Drives must be enabled before motion commands are issued to them in a user program. Check the Axis Disable bit in Axis D's Control Register, Axis D's status bits, the fiber-optic ring, and the power circuit.
427 Calc: invalid table index D	In a user program calculation expression, the index to a point or event table is invalid. See the diagnostic message for each task to find out which task has this error, then check the variable that is used to index the table.
428 Calc: division by zero	In a user program calculation instruction, an attempt was made to divide a number by zero. See the diagnostic message for each task to find the task and the instruction, then check the variables used in the expression.
429 Calc: too many operands	In a user program calculation instruction, more than 1000 operands and operators were in the string. See the diagnostic message for each task to find the task and the instruction.
430 Calc instruction: invalid operator	An invalid arithmetic operator was found in a user program calculation instruction. Check the compiler and firmware version numbers, and call Indramat service for assistance.
431 Calc error: see Task A diag.	An error has occurred in a user program calculation instruction. See the task diagnostic message for a communication error message.
432 Calc: too many nested expressions	In a user program calculation instruction, more than 16 operations were pending. See the diagnostic message for each task to find the task and the instruction. Then check the number of operands in the expression, looking for unbalanced parentheses.
433 Setup instruction outside of a task	The following commands must be placed in a task's main program: TASK/AXES, KINEMATIC, and DATA/SIZE. This error is issued if any of these commands are found in a subroutine. Move the instructions to Task A, B, C, or D, following the TASK/START instruction or Axis Setup icon.
434 Axis D configured more than once	Axis D was selected more than once in a TASK/AXES command (axis setup icon). Modify the program so that the axis is selected once.
435 Axis D not associated with a task	Axis D was not associated with a task using the TASK/AXES command but was used in another command. Modify the program so that the axis is selected.

Code	Description
436 General Compiler Error: XXXX	An error was found in a compile-time instruction (TASK/AXES, KINEMATIC) after program activation. See the task diagnostic message for a description. If there is no task diagnostic message, call Indramat for assistance. One possible cause of this error is powering up a system with DIAX02 drives that is unable to read the motor data from the MDD motor. This results in “System: 436 General Compiler Error: 008D”. This can be caused by a disconnected or damaged feedback cable or a hardware failure (encoder or feedback circuitry in the drive).
437 Axis D not controlled by this task	Single-axis motion was started from a task not associated with an axis. Motion can only be started from a task with axes selected in the TASK/AXES command.
438 Invalid Axis Selected: D	Axis D was not found on the SERCOS ring or is an invalid axis number. This error is issued during single-axis or ELS motion commands. Check the constant or variable that contains the axis number.
439 Invalid Motion Type: D	The axis type does not match the type of motion used by the instruction. This error is issued when a single-axis command is given to a coordinated motion axis, for example.
440 I-O Transfer Error: see task diag.	An error occurred while reading or writing an I-O register. See the task diagnostic message for a description.
450 Event D: invalid event type	The event type selected in the event table is not valid or does not match the type of motion or event. This error is also issued if an event/trigger (event arm) is executed for a motion-based event.
451 Invalid event number D	The event number is not within the bounds selected with the data/size command for this task.
452 More than D event timers armed	Only 'D' repeating timer events can be armed at one time. Check the program flow to make sure that triggered events are being disabled.
453 Homing param. transfer error: D	A SERCOS communication error occurred during a drive-controlled homing command. 'D' indicates the communication error code returned by the drive. Try to home the axis again. If this error still occurs, call Indramat for assistance.
454 Axis D homing not complete	The drive did not successfully complete the homing sequence. See the drive diagnostics for a status or error message.
459 Axis D target position out of bounds	The programmed position in an axis/move command exceeds the drive's travel limits. Adjust the travel limits or check the variable or constant containing the position.
460 Invalid program D from binary inputs	The program selected from the Binary Program Select bits does not exist on the card or is greater than the maximum number of programs.
461 System Error	This error is not issued in current CLC versions and is reserved for future use.
462 System Error	This error is not issued in current CLC versions and is reserved for future use.
463 Ratio command: invalid ratio	In the RATIO command, one of the factors is too large or the master factor is zero.
464 Can't activate while program running	A new program cannot be selected through the Binary Program Select inputs unless the program is stopped.
465 Drive D config. error, see ext. diag, or Drive D: telegram type not supported (versions before 01.20)	Drive D does not support a product-specific option or a drive configuration calculation has failed. The extended diagnostic message (C1.124, or in Status-System menu) describes the error in more detail. It often shows the parameter that failed along with a short message describing the error. If it indicates that a parameter is invalid or a configuration is not supported, check the axis configuration with the drive hardware or software. If the extended diagnostic indicates an error such as ‘Handshake time-out’ or ‘Drive is not responding’, the SERCOS ring may have been disconnected during initialization. Check the fiber optic connections and the addresses of the drives on the ring.

Code	Description
466 Drive D: scaling type not supported	Check the axis configuration with the drive hardware or software. *Note:* This error is issued only in versions that do not use the SERCOS ASIC (firmware versions less than 01.20).
469 Axis D accel <= 0 or > maximum	The acceleration or deceleration programmed for axis D is negative, zero, or exceeds the maximum acceleration or deceleration parameter (Ax.21 or Ax.22).
470 Axis D velocity > maximum	The velocity programmed for axis D is exceeds the maximum velocity parameter (Ax.20).
474 Drive D cyclic data size too large	Too much data is configured in the SERCOS cyclic telegram. The drives currently support up to 16 bytes of configurable data. Remove I-O or registration options from the parameter or program configuration.
475 Axis D capture already configured	An axis has been configured for the feedback capture function in a previous user program command. Only one capture/setup command is allowed for each axis.
476 Axis D: Real Time Bit Setup Error	A SERCOS error occurred while the CLC was configuring the drive's real time bits for the feedback capture function. Clear the error, enter parameter mode to reinitialize SERCOS, and then exit parameter mode.
477 Axis D: probe edge not configured	This error, issued in the capture/enable instruction, indicates that the selected probe edge for the event has not been configured with the capture/setup instruction.
478 Calc: operand out of range	The operand of a calculation function is out of the range of valid arguments, as when a square root or a logarithmic of a negative number is attempted.
479 Drive D: too many cyclic data elements	The DDS 2.1 currently allows 4 cyclic data elements for the AT and MDT. Remove options such as I-O cards and probing. Refer to the SERCOS Cyclic Telegram Configuration
480 SERCOS Error: MDT is too large	The DDS 2.1 currently allows 104 bytes in the MDT. Remove options such as I-O cards and probing, or reduce the number of drives on the ring. Refer to the SERCOS Cyclic Telegram Configuration
481 Event D is already armed	An event that is currently armed has been armed again using event/trigger (event arm) or the VME event instructions.
482 Checksum Error in Program	The currently active program's checksum doesn't match the checksum that is stored in memory. This indicates that a system error has caused the CLC to overwrite memory. Contact Indramat service for assistance.
483 Parameter Init. Error: see Task A diag	There is an error in the parameter initialization or bit initialization instruction; which is executed when exiting parameter mode. The parameter format, parameter number, or stored value may be invalid. A communication error message is displayed in the diagnostic message for the task (A-D) in which the error occurred (***T-0-0122***). Information on the actual parameter number that caused the error is provided in extended diagnostics (***C-0-0124***). In many cases, this error is issued when a drive is not on the ring or the drive parameter is not found for a type of drive.
484 CLC SYSTEM ERROR	This error indicates a problem in the CLC executive firmware. See the extended diagnostics parameter (***C-0-0124***) for more information, and call the Indramat service department for assistance.
485 SERCOS I-O: too many registers configured	More than 50 SERCOS I-O registers were configured in the CLC, which exceeds the system limit. This includes both drive-resident I-O and SERCOS I-O slaves.
486 SERCOS Device D is not a drive	The SERCOS device with address D was enabled in the user program or parameters as an axis, but an I-O slave or other type of slave was detected.
487 Cam D is invalid or not stored	In the cam/activate command, the selected cam ('D') is not stored on the card or does not contain valid data. Check the variable or constant that selects the cam. Check that there is a valid cam with index 'D' stored on the CLC.
488 Cam Error: See Task A diag.	An error was issued during a cam command in task (A-D). See the task diagnostic message (***T-0-0122***) for a description.
489 More than D cam axes selected	The CLC limits the number of axes configured as CLC Cam Axes to 'D'.

Code	Description
490 System Memory Allocation Error	The dynamic memory space on the CLC has been exhausted. Contact Indramat Service for assistance.
492 Programs were lost	User programs and data were lost. The RAM backup battery has failed or was not connected, or an internal system error has corrupted the memory. For the CLC/V, the card may have been removed from the VME rack.
493 Data was restored from Flash	User programs and parameters have been restored from Flash EPROM. If the card has just been installed in the VME rack and a valid program is active, clear this error and proceed. If the card has not just been installed, this indicates that the VME standby battery has failed and the previous program and data has been replaced with that stored in Flash.
494 Sequencer init. error: see task T diag	An error has occurred in a sequencer/initialize instruction in task 'T'. The task diagnostic (***T-0-0122***) and the extended diagnostic (***C-0-0124***) give a more detailed description of the error.
495 Sequencer error: see task T diag.	An error has occurred in a sequencer/execute instruction in task 'T'. The task diagnostic (***T-0-0122***) and the extended diagnostic (***C-0-0124***) give a more detailed description of the error.
496 Can't Execute this Instruction from an Event	This user program instruction cannot be executed from within an event. See the task error descriptions and the current program instruction. Some operations, such as sequencer initialization, cannot take place during an event. Move the instruction into a main user task or subroutine
497 Limit switch config. error, see ext. diag	This error is issued at activation of a program when one of the PLS parameters defined in the program is invalid. It is also issued when the ELS setup is incorrect for PLS operation. Parameter ***C-0-0124*** provides a detailed description of the error as an extended diagnostic message.
498 Drive D Shutdown Warning	This error is issued when any drive has a Class 2 shutdown warning. The tasks that stop for errors switch into manual mode and perform a controlled stop of all axes. A drive warning indicates a condition that will later cause a shutdown, but is serious enough to require immediate attention. Since the warning may have already been cleared on the drive, the extended diagnostic (***C-0-0124***) latches the class 2 diagnostic bits (drive parameter S-0-0012) from the drive so that this condition can be corrected. **Note**: Class 2 warnings may not be detected by the CLC if drive parameter S-0-0012 is being continuously read by the user interface or user program, since the diagnostic change bit is reset whenever this parameter is read.
499 Axis number D not supported in this version	This version of CLC software is limited to less than D axes. The axis number is limited to the number of axes allowed. Currently, the standard version of CLC allows 4 axes, and the enhanced version 40 axes.
500 Axis D is not referenced	Axis D has not been homed, the reference position has not been set, or the reference position has been lost. The reference position bit in drive parameter S-0-0403 is zero. To enable or disable this error, use parameter A-0-0006.
501 Drive D communications error	An error in drive communications has occurred while the CLC was reading or writing a service channel parameter for an internal operation. Parameter C1.124, extended diagnostics, has a detailed description of the error.
503 Executing empty block #D	This error is reserved for use by the TRANS01-D control. See the documentation for this version.
504 Communication Time-out	During a timed serial port transmission, the serial port has not responded within the time set in parameter C-0-0016. Timed transmissions used for jogging through Visual Motion. If this error occurs, increase the time-out value in C-0-0016.
505 Axis D is not configured	A user program command was issued to Axis D, but axis D is not configured in the program. Modify the user program so that the correct axis is addressed, or exclude the axis from the system using parameter A-0-0007.
506 I-O Mapper initialization error	The I-O mapper was invalid at initialization, due to loss of memory or an incompatibility in the mapper version.

Code	Description
507 Option Card Power Supply Error	There is an external power supply or output driver error on a DEA-28 expansion card connected to the CLC-D. This error is issued only in Run Mode (phase 4). All inputs are read as 0, and all outputs are turned off. When a 507 error occurs, check parameter C-0-0031 to find the cards that have the error condition. Check the ERR LED on the DEA/C. If it is on, check the current draw of the devices connected to the outputs. If the ERR LED is off, check the +24V external power supply signal to see if it is connected and if it falls within the specified range. (See DEA Section.)
508 User Watchdog Time-out	Contact Indramat
509 CLC System Timing Error	Contact Indramat
511 Adaptive Depth Pre-Limit Error	Before executing an adaptive depth controlled move (G08), the linear encoder has not attained the minimum amount of deflection, as set in Axis Parameter Aa31, Linear Encoder Pre-Limit. That is, the tool (or axis) has moved close enough to the surface of the part.
512 Adaptive Depth Part Not Found	Before executing an adaptive depth controlled move (G08), the linear encoder has not attained any amount of deflection at all, i.e., the machine as not located the part.
513 Positive Stop Not Found	Fault message. Programmed distance was achieved while executing a positioning move to a positive stop (G75). Positive stop was not found. Check: • condition of positive stop and motor drive train • if present, check for faulty wiring to solenoids, or for defective solenoids.
514 CLC System Error	Hardware failure. Replace TRANS 01-D.
516 More than %d registration functions enabled	Contact Indramat
517 Axis %d: Missed registration mark limit exceeded	Contact Indramat
518 Axis %d Transfer Enable Limit Error	Value entered in process parameter P10 is outside the permissible range defined in Overtravel limit parameter Aa06.
519 Fieldbus Link Error	The fieldbus module is not actively communicating with the fieldbus master. If the master detects a communication fault with one of the slaves and stops communication, this error will be detected and displayed by the TRANS 01-D. It may also be caused by a break in the communication due to removed or damaged fieldbus cable or failed communication hardware. This fault message also will be displayed if the I/O type is improperly configured for fieldbus (Interbus-S 1 or 2) in parameter P2 when there is no fieldbus module in the system. This could happen, for example, if parameters from a system with fieldbus are restored to a TRANS 01-D with a DEA I/O card.

6.2 TRANS 01-D-Specific Diagnostic Messages

TRANS 01-D specific diagnostic messages are assigned the addresses 700-818. Many of the TRANS 01-D diagnostic and status messages are derived directly from the CLC-D card software.

TRANS 01-D Messages (700 - 899)

Code	Description
700 ACKN-INPUT 1 WAIT OFF	Status message. The machine function controlled by Auxiliary Function 1 output has turned off, but the TRANS 01-D has not yet received acknowledgment. The program is paused, and 24V is still present at ACKN-INPUT 1. The TRANS 01-D will wait indefinitely for the acknowledgment, i.e., there is no time-out. If you suspect a problem, check for: • a stuck or shorted switch • an improperly programmed PLC contact.
701 ACKN-INPUT 1 WAIT ON	Status message. The machine function controlled by Auxiliary Function 1 output has turned on, but the TRANS 01-D has not yet received acknowledgment. The program is paused, and 24V is not present at ACKN-INPUT 1. The TRANS 01-D will wait indefinitely for the acknowledgment, i.e., there is no time-out. If you suspect a problem, check for: • a broken wire on the acknowledgment input • a faulty input switch • an incorrectly timed PLC program.
702 ACKN-INPUT 2 WAIT OFF	Status message. The machine function controlled by Auxiliary Function 2 output has turned off, but the TRANS 01-D has not yet received acknowledgment. The program is paused, and 24V is still present at ACKN-INPUT 2. The TRANS 01-D will wait indefinitely for the acknowledgment, i.e., there is no time-out. If you suspect a problem, check for: • a stuck or shorted switch • an improperly programmed PLC contact.
703 ACKN-INPUT 2 WAIT ON	Status message. The machine function controlled by Auxiliary Function 2 output has turned on, but the TRANS 01-D has not yet received acknowledgment. The program is paused, and 24V is not present at ACKN-INPUT 2. The TRANS 01-D will wait indefinitely for the acknowledgment, i.e., there is no time-out. If you suspect a problem, check for: • a broken wire on the acknowledgment input • a faulty input switch • an incorrectly timed PLC program.
704 ACKN-INPUT 3 WAIT OFF	Status message. The machine function controlled by Auxiliary Function 3 output has turned off, but the TRANS 01-D has not yet received acknowledgment. The program is paused, and 24V is still present at ACKN-INPUT 3. The TRANS 01-D will wait indefinitely for the acknowledgment, i.e., there is no time-out. If you suspect a problem, check for: • a stuck or shorted switch • an improperly programmed PLC contact.

Code	Description
705 ACKN-INPUT 3 WAIT ON	Status message. The machine function controlled by Auxiliary Function 3 output has turned on, but the TRANS 01-D has not yet received acknowledgment. The program is paused, and 24V is not present at ACKN-INPUT 3. The TRANS 01-D will wait indefinitely for the acknowledgment, i.e., there is no time-out. If you suspect a problem, check for: • a broken wire on the acknowledgment input • a faulty input switch • an incorrectly timed PLC program.
706 ACKN-INPUT 4 WAIT OFF	Status message. The machine function controlled by Auxiliary Function 4 output has turned off, but the TRANS 01-D has not yet received acknowledgment. The program is paused, and 24V is still present at ACKN-INPUT 4. The TRANS 01-D will wait indefinitely for the acknowledgment, i.e., there is no time-out. Only available when DEA 4.X and DEA 5.X I/O cards are present in combination and configured correctly, or when Interbus-S I/O is used. If you suspect a problem, check for: • a stuck or shorted switch • an improperly programmed PLC contact.
707 ACKN-INPUT 4 WAIT ON	Status message. The machine function controlled by Auxiliary Function 4 output has turned on, but the TRANS 01-D has not yet received acknowledgment. The program is paused, and 24V is not present at ACKN-INPUT 4. The TRANS 01-D will wait indefinitely for the acknowledgment, i.e., there is no time-out. Only available when DEA 4.X and DEA 5.X I/O cards are present in combination and configured correctly, or when Interbus-S I/O is used. If you suspect a problem, check for: • a broken wire on the acknowledgment input • a faulty input switch • an incorrectly timed PLC program.
708 ACKN-INPUT 5 WAIT OFF	Status message. The machine function controlled by Auxiliary Function 5 output has turned off, but the TRANS 01-D has not yet received acknowledgment. The program is paused, and 24V is still present at ACKN-INPUT 5. The TRANS 01-D will wait indefinitely for the acknowledgment, i.e., there is no time-out. Only available when DEA 4.X and DEA 5.X I/O cards are present in combination and configured correctly, or when Interbus-S I/O is used. If you suspect a problem, check for: • a stuck or shorted switch • an improperly programmed PLC contact.
709 ACKN-INPUT 5 WAIT ON	Status message. The machine function controlled by Auxiliary Function 5 output has turned on, but the TRANS 01-D has not yet received acknowledgment. The program is paused, and 24V is not present at ACKN-INPUT 5. The TRANS 01-D will wait indefinitely for the acknowledgment, i.e., there is no time-out. Only available when DEA 4.X and DEA 5.X I/O cards are present in combination and configured correctly, or when Interbus-S I/O is used. If you suspect a problem, check for: • a broken wire on the acknowledgment input • a faulty input switch • an incorrectly timed PLC program.

Code	Description
710 ACKN-INPUT 6 WAIT OFF	Status message. The machine function controlled by Auxiliary Function 6 output has turned off, but the TRANS 01-D has not yet received acknowledgment. The program is paused, and 24V is still present at ACKN-INPUT 6. The TRANS 01-D will wait indefinitely for the acknowledgment, i.e., there is no time-out. Only available when DEA 4.X and DEA 5.X I/O cards are present in combination and configured correctly, or when Interbus-S I/O is used. If you suspect a problem, check for: • a stuck or shorted switch • an improperly programmed PLC contact.
711 ACKN-INPUT 6 WAIT ON	Status message. The machine function controlled by Auxiliary Function 6 output has turned on, but the TRANS 01-D has not yet received acknowledgment. The program is paused, and 24V is not present at ACKN-INPUT 6. The TRANS 01-D will wait indefinitely for the acknowledgment, i.e., there is no time-out. Only available when DEA 4.X and DEA 5.X I/O cards are present in combination and configured correctly, or when Interbus-S I/O is used. If you suspect a problem, check for: • a broken wire on the acknowledgment input • a faulty input switch • an incorrectly timed PLC program.
712 ACKN-INPUT 7 WAIT OFF	Status message. The machine function controlled by Auxiliary Function 7 output has turned off, but the TRANS 01-D has not yet received acknowledgment. The program is paused, and 24V is still present at ACKN-INPUT 7. The TRANS 01-D will wait indefinitely for the acknowledgment, i.e., there is no time-out. Only available when Interbus-S I/O is used. If you suspect a problem, check for: • a stuck or shorted switch • an improperly programmed PLC contact.
713 ACKN-INPUT 7 WAIT ON	Status message. The machine function controlled by Auxiliary Function 7 output has turned on, but the TRANS 01-D has not yet received acknowledgment. The program is paused, and 24V is not present at ACKN-INPUT 7. The TRANS 01-D will wait indefinitely for the acknowledgment, i.e., there is no time-out. Only available when Interbus-S I/O is used. If you suspect a problem, check for: • a broken wire on the acknowledgment input • a faulty input switch • an incorrectly timed PLC program.
714 DWELL-TIME	Status message. Executing a dwell time function (G04) as part of program sequence.
715 FORWARD FINISHED	Status message. Manual mode, forward program cycle completed, but Forward input still at 24V (high). Control (push-button) may be stuck, or PLC output may be latched high.
716 FORWARD IMMEDIATE STOP	Status message. Manual mode, forward program cycle begun at CTA10-1 is interrupted, either by CTA10-1 (Cycle Stop button) or a soft fault. To continue: • press Cycle Start button on CTA10-1 • press Fault Clear pushbutton on I/O control panel.

Code	Description
717 FORWARD NO COMMAND	Status message. Forward signal lost during manual mode program cycle. Push-button may have been released, but also check for: • loose or broken connection to push-button switch • switch failure • lost PLC output.
718 FORWARD OPERATING	Status message. Manual mode, forward program cycle in progress.
719 IMMEDIATE STOP	Status message. TRANS 01-D status after a soft/hard fault condition has been cleared. Servo drive power is present, and machine is ready for Start/Restart signal (or Forward/Reverse signal high).
720 NO ENABLE	Status message. 24V not present at Enable input.
721 NO ENABLE FORWARD	Status message. 24V not present at Enable-Forward input.
722 NO START	Status message. Machine is in Auto mode and ready for Start signal (all axes are enabled and homed, and there are no faults)
723 OPERATOR NO COMMAND	Status message. Machine is in Manual mode and ready for Start signal from CTA10-1.
724 READY MISSING	Status message. In Auto mode, one or more axes have not been homed.
725 REVERSE FINISHED	Status message. Manual mode, reverse program cycle completed, but Reverse input still at 24V (high). Control (push-button) may be stuck, or PLC output may be latched high.
726 REVERSE IMMEDIATE STOP	Status message. Manual mode, reverse program cycle begun at CTA10-1 is interrupted, either by CTA10-1 (Cycle Stop button) or a soft fault. To continue: • press Cycle Start button on CTA10-1 • press Fault Clear pushbutton on I/O control panel.
727 REVERSE NO COMMAND	Status message. Reverse signal lost during manual mode program cycle. Push-button may have been released, but also check for: • loose or broken connection to push-button switch • switch failure • lost PLC output.
728 REVERSE OPERATING	Status message. Manual mode, reverse program cycle in progress.
734 X AXIS: ADAPTIVE DEPTH	Status message. X axis is operating in adaptive depth positioning mode.
735 X AXIS: HOMING	Status message. Executing a homing function (G74) on the previously referenced (homed) X axis.
736 X AXIS: HOMING FINISHED	Status message. Successful completion of home reference sequence, but 24V still present at Home Request input.
737 X AXIS: HOMING TO POSITIVE STOP	Status message. Executing a Homing to Positive Stop sequence (G69) on the X axis.
738 X AXIS: ABSOLUTE POSITIONAL MOVE	Status message. X axis is executing a G90 absolute positional move.
739 X AXIS: INCREMENTAL POSITIONAL MOVE	Status message. X axis is executing a G91 incremental positional move.
740 Y AXIS: ADAPTIVE DEPTH	Status message. Y axis is operating in adaptive depth positioning mode.
741 Y AXIS: HOMING	Status message. Executing a homing function (G74) on the previously referenced (homed) Y axis.
742 Y AXIS: HOMING FINISHED	Status message. Successful completion of home reference sequence, but 24V still present at Home Request input.
743 Y AXIS: HOMING TO POSITIVE STOP	Status message. Executing a homing to positive stop sequence (G69) on the Y axis.
744 Y AXIS: ABSOLUTE POSITIONAL MOVE	Status message. Y axis is executing a G90 absolute positional move.
745 Y AXIS: INCREMENTAL POSITIONAL MOVE	Status message. Y axis is executing a G91 incremental positional move.

Code	Description
746 Z AXIS: ADAPTIVE DEPTH	Status message. Z axis is operating in adaptive depth positioning mode.
747 Z AXIS: HOMING	Status message. Executing a homing function (G74) on the previously referenced (homed) Y axis.
748 Z AXIS: HOMING FINISHED	Status message. Successful completion of home reference sequence, but 24V still present at Home Request input.
749 Z AXIS: HOMING TO POSITIVE STOP	Status message. Executing a homing to positive stop sequence (G69) on the Y axis.
750 Z AXIS: ABSOLUTE POSITIONAL MOVE	Status message. Z axis is executing a G90 absolute positional move.
751 Z AXIS: INCREMENTAL POSITIONAL MOVE	Status message. Z axis is executing a G91 incremental positional move.
752 X AXIS: ESTABLISHING HOME POSITION	Status message. During initial and subsequent G74 homing of the X axis, checking the value of the Reference (Home) position defined in the Axis Parameter Aa13, Reference Position.
753 Y AXIS: ESTABLISHING HOME POSITION	Status message. During initial and subsequent G74 homing of the Y axis, checking the value of the Reference (Home) position defined in the Axis Parameter Aa13, Reference Position.
754 Z AXIS: ESTABLISHING HOME POSITION	Status message. During initial and subsequent G74 homing of the Z axis, checking the value of the Reference (Home) position defined in the Axis Parameter Aa13, Reference Position.
755 ABSOLUTE POSITIONAL MOVE	Status message. Executing an axis move (G90) to an absolute position.
756 INCREMENTAL POSITIONAL MOVE	Status message. Executing an axis move (G91) across an incremental distance.
757 FEED TO POSITIVE STOP	Status message. Executing a positioning move to a positive stop (G75) as part of program sequence.
758 ACKN-INPUT 1 LOST	Soft fault. During program cycle, the status of ACKN-INPUT 1 momentarily changes while the status of Auxiliary Function 1 output does not (i.e., momentary spike from 0V, or momentary loss of 24V). Axis motion is halted, control program sequence is frozen. • May be due to temporary condition (e.g., air bubble in cooling hose); press FAULT CLEAR and START/RESTART • For momentary loss 24V input signal, check for faulty wiring at switch • For voltage spike, check for switch failure.
759 ACKN-INPUT 2 LOST	Soft fault. During program cycle, the status of ACKN-INPUT 2 momentarily changes while the status of Auxiliary Function 2 output does not (i.e., momentary spike from 0V, or momentary loss of 24V). Axis motion is halted, control program sequence is frozen. • May be due to temporary condition (e.g., air bubble in cooling hose); press FAULT CLEAR and START/RESTART • For momentary loss 24V input signal, check for faulty wiring at switch • For voltage spike, check for switch failure.
760 ACKN-INPUT 3 LOST	Soft fault. During program cycle, the status of ACKN-INPUT 3 momentarily changes while the status of Auxiliary Function 3 output does not (i.e., momentary spike from 0V, or momentary loss of 24V). Axis motion is halted, control program sequence is frozen. • May be due to temporary condition (e.g., air bubble in cooling hose); press FAULT CLEAR and START/RESTART • For momentary loss 24V input signal, check for faulty wiring at switch • For voltage spike, check for switch failure.

Code	Description
761 ACKN-INPUT 4 LOST	Soft fault. During program cycle, the status of ACKN-INPUT 4 momentarily changes while the status of Auxiliary Function 4 output does not (i.e., momentary spike from 0V, or momentary loss of 24V). Axis motion is halted, control program sequence is frozen. • May be due to temporary condition (e.g., air bubble in cooling hose); press FAULT CLEAR and START/RESTART • For momentary loss 24V input signal, check for faulty wiring at switch • For voltage spike, check for switch failure.
762 ACKN-INPUT 5 LOST	Soft fault. During program cycle, the status of ACKN-INPUT 5 momentarily changes while the status of Auxiliary Function 5 output does not (i.e., momentary spike from 0V, or momentary loss of 24V). Axis motion is halted, control program sequence is frozen. • May be due to temporary condition (e.g., air bubble in cooling hose); press FAULT CLEAR and START/RESTART • For momentary loss 24V input signal, check for faulty wiring at switch • For voltage spike, check for switch failure.
763 ACKN-INPUT 6 LOST	Soft fault. During program cycle, the status of ACKN-INPUT 6 momentarily changes while the status of Auxiliary Function 6 output does not (i.e., momentary spike from 0V, or momentary loss of 24V). Axis motion is halted, control program sequence is frozen. • May be due to temporary condition (e.g., air bubble in cooling hose); press FAULT CLEAR and START/RESTART • For momentary loss 24V input signal, check for faulty wiring at switch • For voltage spike, check for switch failure.
764 ACKN-INPUT 7 LOST	Soft fault. During program cycle, the status of ACKN-INPUT 7 momentarily changes while the status of Auxiliary Function 7 output does not (i.e., momentary spike from 0V, or momentary loss of 24V). Axis motion is halted, control program sequence is frozen. • May be due to temporary condition (e.g., air bubble in cooling hose); press FAULT CLEAR and START/RESTART • For momentary loss 24V input signal, check for faulty wiring at switch • For voltage spike, check for switch failure.
765 POS STOP MISSING	Positive stop missing. TRANS 01-D reached target position in G75 program block without finding positive stop.
766 RETURN ILLEGAL	Programming Error. Program block contains a JReturn (Return from Subroutine) command while not in subroutine.
767 Drive’s Feed to Positive Stop parameter set to Disabled	Configuration Error. Program block contains a Feed to Positive Stop (G75) command, but Positive Stop is disabled in Axis Parameter Aa01 (Special Functions). • Change Special Functions parameter value for Positive Stop from 0 to 1.
768 Feed to Positive Stop already on	Programming Error. Feed to Positive Stop (G75) commanded in successive blocks. One possible cause of this error is interrupting a Home to Positive Stop operation and then restarting it. Since the Feed to Positive Stop function is actually used within the Home to Positive Stop operation, if interrupted while on the positive stop, Feed to Positive remains active. Trying to home again causes this error even though there may be no G75 Feed to Positive Stop code in the program.
769 Positive Stop Max. feedrate exceeded	Programming Error. Commanded feedrate for G69 or G75 move is higher than the value in Axis Parameter Aa20, Maximum Speed to Positive Stop. Program is halted. • Reduce programmed feedrate, then start program cycle.
770 Auto Mode	Status message. 24V present at Auto/Manual input.
771 Manual Mode	Status message. 24V not present at Auto/Manual input.

Code	Description
772 All Axis have NOT been homed	Hard fault. Attempted to start program cycle, but all of the axes have not been homed.
773 Internal Error	Hard fault. To clear, • press FAULT CLEAR • power down and then power up the TRANS 01-D • contact Indramat.
774 Waiting for External Tool Correction Data	Status message. TRANS 01-D is executing a program block specifying an external offset (tool correction) register and is waiting for the register information to be validated.
775 Feedrate exceeds Maximum Velocity parameter	Programming Error. Programmed feedrate is greater than value in parameter P08, Maximum Path Speed. Program is halted. • Decrease programmed feedrate, or increase the value of Process Parameter P08.
776 Maximum of 9 consecutive G62 blocks exceeded	Programming Error. The maximum **total** number of NC blocks in G61 and G62 can only be 9.
777 Position request during Positive Stop	Programming Error. After executing a move to a positive stop (G75), a position command, e.g., G91, is subsequently programmed before disabling Feed to Positive Stop (G76). • Use G76 before programming a position request.
779 Adaptive Depth not configured for this axis	Configuration Error. Program block contains an adaptive depth positioning (G08) command, but Adaptive Depth is disabled in Axis Parameter Aa01 (Special Functions). • Change Special Functions parameter value for Adaptive Depth from 0 to 1.
780 Maximum Adaptive Depth feedrate exceeded	Programming Error. Programmed feedrate is greater than value in Axis Parameter Aa30, Maximum Speed for Adaptive Depth. Program is halted. • Decrease programmed feedrate, or increase value of Maximum Speed for Adaptive Depth.
781 Maximum Adaptive Depth deflection exceeded	Programming Error. Programmed distance for adaptive depth positioning move (G08) is greater than the value in parameter Aa32, Linear Encoder - Maximum Deflection. • Reduce the commanded (programmed) distance.
782 DIAX02 drive required for Feed/Home to Positive Stop	Configuration/Programming Error. The G75 and G69 commands are valid only for the DIAX02, DIAX03, and DIAX04 drive families.
783 Target position falls within blend radius	Programming Error. While the TRANS 01-D attempts to execute two consecutive positioning moves without lag (G62), the second feedrate is not sufficiently slower than the first feedrate, and axis never reaches the first commanded position. • If this error occurs, use the following rule of thumb to reduce the second commanded feedrate: $F_{next} \leq 15\% \times F_{previous}$.
784 Cannot Enable Axis while in Positive Stop mode	Programming Error. The axis was moved to a positive stop (G75) and then disabled (G21). The program then attempted to re-enable the axis (G20) without first disabling Feed to Positive Stop (G76). • Disable Feed to Positive Stop (G76) before attempting to re-enable the axis (G20).
785 Axis NOT configured for AF switching	Configuration Error. Program block contains a Disable Axis (G21) command, but Axis Parameter Aa16, Axis AF Switching is set to disable this function. • Change the value of Axis AF Switching to enable this function.
786 Axis not configured for Home to Positive Stop operation	Configuration Error. Program block contains Home to Positive Stop (G69) command, but Axis Parameter Aa12, Homing Reference, is not set for homing to a positive stop. **NOTE**: Axis must be equipped with absolute feedback to enable Home to Positive Stop. • Change the Homing Reference value to enable this function.

Code	Description
787 Jog Slow > Rapid speed	Configuration Error. The value for Slow Jog speed is set greater than the Rapid Jog speed, both set in Axis Parameter Aa10, Speeds. • Reduce the Slow Jog speed or increase the Rapid Jog speed.
788 Maximum subroutine nesting of 17 exceeded	Programming Error. Up to 17 subroutines may be nested inside each other. Eliminate any excess subroutines in your program.
789 Jump Wait time-out	Soft fault. The Jump and Wait has timed out before the needed condition occurred. Program is halted. • press FAULT CLEAR and START/RESTART.
790 Rotary Modulo Exceeded in G90 mode	Programming Error. Value of the programmed absolute position is less than zero, or larger than the number of Units per Table Revolution (modulo) set in Axis Parameter Aa02, Units. • Change the value of the absolute position commanded in the program block so that it is greater than zero and less than or equal to the Units per Table Revolution value.
791 Spindle axis not configured	Configuration Error. A spindle position (P) is commanded in a program block, but the S axis (#4) has not been enabled, via System Parameter P02, Axis Configuration. • Change the value of the Axis Configuration parameter for the S axis (#4) from 0 (zero) to 1.
792 Spindle Positioning is Disabled	Configuration Error. A spindle position (P) is commanded in a program block, but the TRANS 01-D has not been configured, via System Parameter P06, System Options, as a spindle positioning control. • Change the Spindle Positioning value of the System Options parameter from 0 (zero) to 1.
794 Part Program must be stopped in G61 mode	Programming Error. The final move in a forward profile (followed by JS000[Jump and Stop]) is not programmed with Lag Finishing (G61). Program sequence is halted. • Change G62 to G61 in the final program block containing a position command.
795 Maximum Tool Correction parameter exceeded	Programming Error. The value contained in the tool correction register called in the program block is larger than the value set in Axis Parameter Aa15, Maximum Tool Correction. • Reduce the value in the tool correction register, change the program block to call the correct tool correction register, or increase the Maximum Tool Correction value.
796 G69 Requires Software Travel Limits Enabled	Configuration Error. A Home to Positive Stop command has been requested, but overtravel limits have been disabled, i.e., Axis Parameter Aa06, Overtravel Limits, are set to 0 (zero). Change the values in parameter Aa06 as required.
797 Adaptive Depth Enabled	Programming Error. With a DIAX02 drive, a Feed to Positive Stop (G75) is commanded, but the axis is already enabled for adaptive depth control (G08), or vice versa. These two commands are mutually exclusive. Disable one function before programming the other.
798 G62 not allowed with Feed to Positive Stop	Programming Error. Feed to Positive Stop (G75) is programmed G62 (without lag). Change to G61 (Finishing with Lag).

Code	Description
799 Home Switch Error	Soft Fault. While Axis Parameter Aa01 is configured to monitor the home switch, one of three events occurred: 1. the homed axis was commanded to move off the Home switch, but the Home switch input does not go low (24V not present) within four encoder revolutions 2. the homed axis is away from the Home switch, but the Home switch input goes high (24V present) 3. the axis reaches the Home (Reference) position, but the Home switch input does not go high (24V present). **NOTE**: This message is displayed only after program cycle completion (JS000 is executed). Check for: • loose contact/wire at home switch • loose encoder coupling • faulty home switch • chips tangled in home switch • partially welded home switch contacts • excessive backlash in drive train.
800 Invalid Tool Correction Register specified	Programming Error. Tool register specified for disabled axis. Enable axis, or specify correct tool correction register.
801 Spindle Positioning not allowed in G62 mode	Programming Error. Spindle axis position (P) is programmed G62 (without lag). Change to G61 (Finishing with Lag).
802 Program Mode	Status message.
803 Waiting for X axis in-position	Status message. The TRANS 01-D is waiting for the actual position of the X axis to reach the In-Position tolerance (defined in Axis Parameter Aa17, Control Windows) of the commanded (programmed) position. The control will wait up to 30 seconds.
804 Waiting for Y axis in-position	Status message. The TRANS 01-D is waiting for the actual position of the Y axis to reach the In-Position tolerance (defined in Axis Parameter Aa17, Control Windows) of the commanded (programmed) position. The control will wait up to 30 seconds.
805 Waiting for Z axis in-position	Status message. The TRANS 01-D is waiting for the actual position of the Z axis to reach the In-Position tolerance (defined in Axis Parameter Aa17, Control Windows) of the commanded (programmed) position. The control will wait up to 30 seconds.
806 X Axis In-Position time-out	Hard Fault. X axis never reached In-Position tolerance of commanded (programmed) position. Check for: • obstruction of axis drive train • In-Position Window (Axis Parameter Aa17) too small • velocity loop gain (Axis Parameter Aa08) too low.
807 Y Axis In-Position time-out	Hard Fault. Y axis never reached In-Position tolerance of commanded (programmed) position. Check for: • obstruction of axis drive train • In-Position Window (Axis Parameter Aa17) too small • velocity loop gain (Axis Parameter Aa08) too low.

Code	Description
808 Z Axis In-Position time-out	Hard Fault. Z axis never reached In-Position tolerance of commanded (programmed) position. Check for: • obstruction of axis drive train • In-Position Window (Axis Parameter Aa17) too small • velocity loop gain (Axis Parameter Aa08) too low.
809 Hand Mode	Status message. 24V present at Hand Mode input.
810 X Axis not ready/enabled	Soft Fault. X axis was commanded to execute motion in the NC port program but is in an “Ab” drive state *or* has not been enabled in CTA10-1 process parameter #2.
811 Y Axis not ready/enabled	Soft Fault. Y axis was commanded to execute motion in the NC port program but is in an “Ab” drive state *or* has not been enabled in CTA10-1 process parameter #2.
812 Z Axis not ready/enabled	Soft Fault. Z axis was commanded to execute motion in the NC port program but is in an “Ab” drive state *or* has not been enabled in CTA10-1 process parameter #2.
813 G08 depth is less than or equal to Adaptive depth pre-limit	"The value of the axis depth (distance of travel) in the G08 block is less than or equal to the Pre-limit value located in axis parameter Aa31. Example block: G08 G91 G61 Z**10** M10000000000 Axis parameter Aa31 value: **11**
814 Can't perform X-axis G74 on un-referenced Multi-turn feedback	Absolute encoder for the X-axis needs to be re-referenced using either a G69 programming command, CTA10-1 (setting absolute encoder under menu key selection 5) or VisualTRANS motor reference utility.
815 Can't perform Y-axis G74 on un-referenced Multi-turn feedback	Absolute encoder for the Y-axis needs to be re-referenced using either a G69 programming command, CTA10-1 (setting absolute encoder under menu key selection 5) or VisualTRANS motor reference utility.
816 Can't perform Z-axis G74 on un-referenced Multi-turn feedback	Absolute encoder for the Z-axis needs to be re-referenced using either a G69 programming command, CTA10-1 (setting absolute encoder under menu key selection 5) or VisualTRANS motor reference utility.
817 G04 is not allowed in G62 move	Since a G62 move sequence is intended to execute as a series of moves with blended velocity profile changes without dropping the axis velocity to zero, it does not make sense to have a dwell (which would cause axis motion to stop) within the G62 move. G04 within a G62 cause an error.
818 G62 Positional Move Sequence	This is a status message that indicates that a G62 move sequence is being executed. While in a G62 sequence, the status of individual block moves (like ABSOLUTE POSITIONAL MOVE, INCREMENTAL POSITIONAL MOVE, FEED TO POSITIVE STOP, etc.) is not displayed.

6.3 CTA10 Exception Errors (System Error codes)

The following is a list of exception errors that may be reported when there is an internal fault detected in the CTA:

CTA10 Exception Error 1	
Error #	**Error Description**
2	Bus Error
3	Address Error
4	Illegal Instruction
5	Divided By Zero
8	Privilege Violation
15	Uninitialized Interrupt
24	Spurious Interrupt
64	Non-Auto Vectors
256	All Undefined Exceptions
257	Stack Overflow

CTA10 Exception Error 2 (Kernel Errors > 256):	
Error #	**Error Description**
300	Kernel Memory Allocation
301	System Keyboard
302	Keyboard Type
303	SPK Version
304	Kernel Power Fail
305	Com Open Failed
306	No Null Process
307	No Desktop
308	No Default Class
309	Stack Overflow
310	Invalid Flash
311	Flash Failed

A typical example of how the error code appears in the on screen display is:

SYSTEM ERROR:304 **PC:001C14 SR:26**

This error may occur if the 24 Vdc power supply to the CTA10 drops for a short time and then returns to normal. This can cause Kernel Power Fail (Error 304).

A CLC DDE SERVER

A.1 Dynamic Data Exchange

The Microsoft Windows operating system specifies a method for transferring data between applications which is called dynamic data exchange (DDE). DDE is a message protocol that developers can use for exchanging data between Windows-based applications. The CLC communication server uses the dynamic data exchange management library (DDEML) which is built on top of the DDE protocol. The DDEML provides services that the message-based DDE protocol does not support. Under the DDEML a client application requests information from a server application, or it sends unsolicited data to the server. The client does this by passing predefined ASCII strings to the server through the DDEML.

Before a client and server can exchange data, they must first agree upon what they are going talk about. This is done by establishing a conversation. Conversations are defined by a service name and a topic name. The CLC server application uses this information to specify how and who to communicate with. After having established a conversation, the client application can now pass data. This is done by specifying an item name. The item name identifies the specific data to be passed.

There are three basic types of data transactions which can be initiated by the client application. A ***request*** transaction is used to obtain data from the server. The server application knows how to obtain the requested information. The second type of transaction is an ***advise link***. After a client application establishes an advise link with a server, it is up to the server to poll the data for changes. If the server finds that the data has changed it will notify the client application. The third type of transaction is a ***poke***. A poke transaction is used to send data for a specific item to the server.

The Dynamic Data Exchange Server

CLC_DDE is a Windows based Dynamic Data Exchange (DDE) Server application which is used to communicate with Indramat's CLC motion control cards. It has been implemented using windows dynamic data exchange management library (DDEML).

Key Features

- Serial connection to a CLC card with support for an RS485 auto switching adapter.
- Support for a modem connection to a CLC card (AT protocol).
- VME back plane communications from a XYCOM PC (Requires *XVME984.DLL*).
- VME back plane communications from a GE FANUC Plug & Play PC (Requires *VPCMTK.DLL*).
- Direct PC AT bus communication to a CLC-P card (Requires *CLC_P.DLL*).
- Connection for editing a CLC compiled program file off line (Requires *CLC_FILE.DLL*).
- Demonstration connection for testing client applications off line (Requires *DEMO.INI*).
- Access to server parameters and status through DDE.
- Supports *Request, Advise* and *Poke* transactions.

Dynamic Data Exchange Interface

A windows application, known as a *client,* can pass information between other applications known as *servers* using Dynamic Data Exchange (*DDE*). A client establishes a conversation with a server specifying a *Service* and a *Topic*. Once a conversation has been started, a client may request or send information by specifying an *item*.

Service Name

The CLC communication server supports two DDE service names. The standard service name is ***CLC_DDE***. This should be used for all connections except when connecting to a CLC compiled program file. For this case use ***CLC_FILE***.

Topic Name

When the standard service name is used to exchange CLC data, the topic name identifies the method of connection to the CLC card and the card unit number. Valid strings consist of a communication device name and a unit number. Valid device names are ***SERIAL_***, ***AT_MODEM_***, ***XYCOM_***, ***GE_P&P_***, ***DEMO_*** or ***ISA_*** and valid card unit numbers are '0' to 'F'. Connections which use the CLC_FILE service should specify the CLC program file as the topic name. If the file is not located in the same directory as clc_dde.exe then the complete path should be included. To exchange server data the service name should be CLC_DDE and the topic name should be **SERVER**. This is the only topic which will not support an advise link. *See section SERVER Topic Name.*

Example: **"SERIAL_0"** Serial connection to a CLC card designated as unit '0'.

"XYCOM_B" Xycom PC in VME rack talking to a CLC_V card designated as unit 'B'.

"ISA_1" PC talking over the ISA bus to a CLC_P card designated as unit 1.

"SERVER" Exchange CLC_DDE server information.

Item Name

The item name identifies the specific data to exchange. When exchanging CLC data the item name consists of a string which contains the class, subclass and data identifiers of the information for the CLC card. The strings follow the ASCII serial protocol. **Refer to *Appendix B. Direct ASCII Communication* for an explanation of these codes.** When exchanging server data the item name should consist of the section and entry name from the INI file (clc_dde.ini). The two names must be divided by a pipe ('|') character. Not all server data has read/write capabilities.

Example: **"RX 0.10"** Specifies register 10 in hexadecimal format.

"TP 2.20" Specifies task B parameter 20.

"CP 1.122" Specifies card parameter 122.

"SERIAL|Baudrate" Specifies the baud rate to use for serial connections.

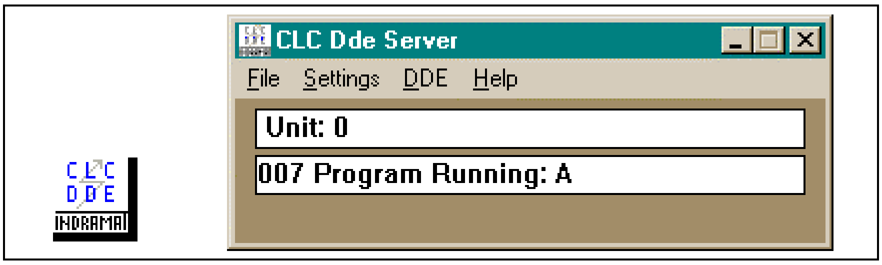
Note: Serial connections directed at different units will be passed through the VME backplane to the proper unit (CLC-V only). This allows communications with any CLC_V card in the VME rack with only one serial connection.

A.2 The Communication Servers Main Window

CLC_DDE displays the unit number and current status for the selected CLC control card. To display the status for a different CLC card or to disable this feature, open the server configuration dialog box under the settings menu item. Select the desired connection/unit from the CLC status display combo box.

When CLC_DDE is in an icon state the tip of the arrow will change colors depending on the communication state. A green tip means that the server is actively communicating, and a red tip indicates that the server is in an error state. If the monitored CLC card's status indicates an error state while the application is an icon, the server window will be restored to the normal state.

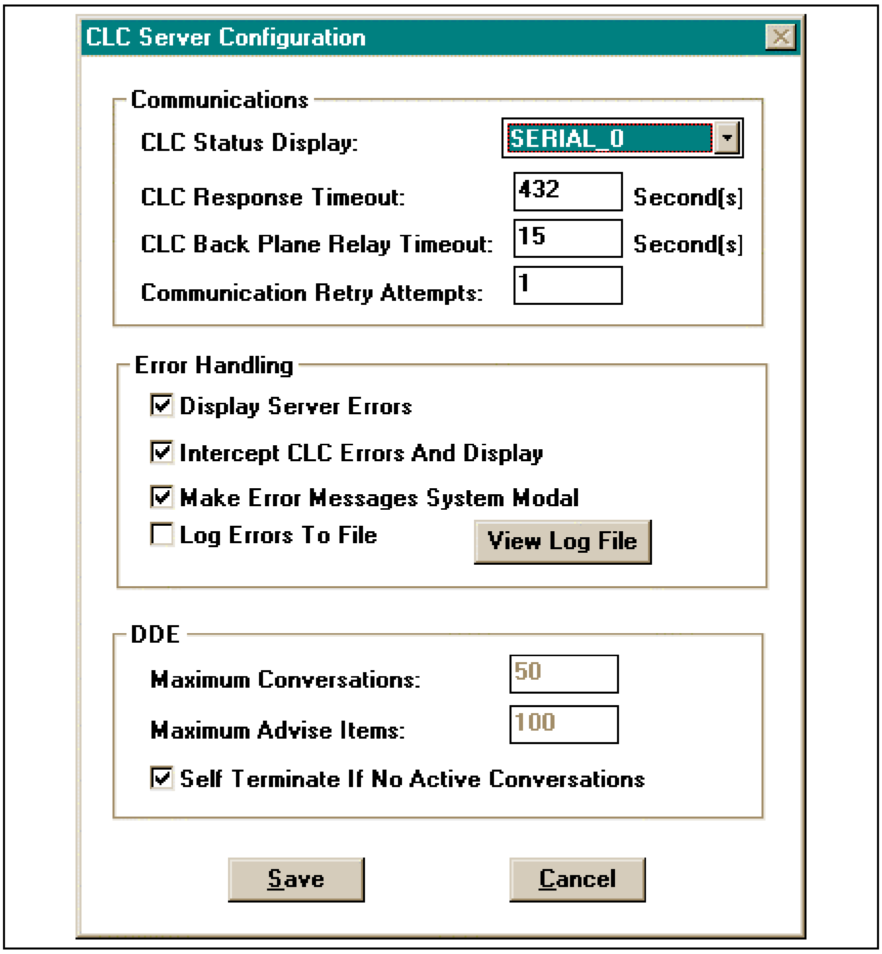
When the CLC DDE Server is running, either the icon or the dialog box below is displayed.



If the icon is displayed, double-clicking the icon restores the dialog box. The CLC DDE Server dialog box contains three selections on the main menu bar: File, Settings and DDE.

Settings Menu - CLC Server Configuration

The CLC Server Configuration allows setting of various system parameters as well as providing performance status information.



Communication

CLC Status Display	Selects the CLC device/unit (i.e. serial_0) combination to be displayed in the status window of the server . The request will be inserted into the standard client advise loop queue. This feature can be turned off by selecting “Disable Status”.
CLC Response Time-out	The amount of time in seconds that the server will wait for a completed response from the CLC control card before diagnosing a disconnect. The valid range of values is 1-900 seconds.
CLC Back Plane Relay Time-out	CLC-V control cards have the ability to redirect incoming serial messages over the VME back plane to other CLC-V cards in the same rack. This allows a host to address multiple control cards with one serial connection. These transmissions may require more time than a direct serial link. The relay time-out value is used for these transactions. The valid range of values is 1-900 seconds.
Communication Retry Attempts	The number of times the server will re-send a message before it issues an error. The valid range of values is 0-255.

Error Handling

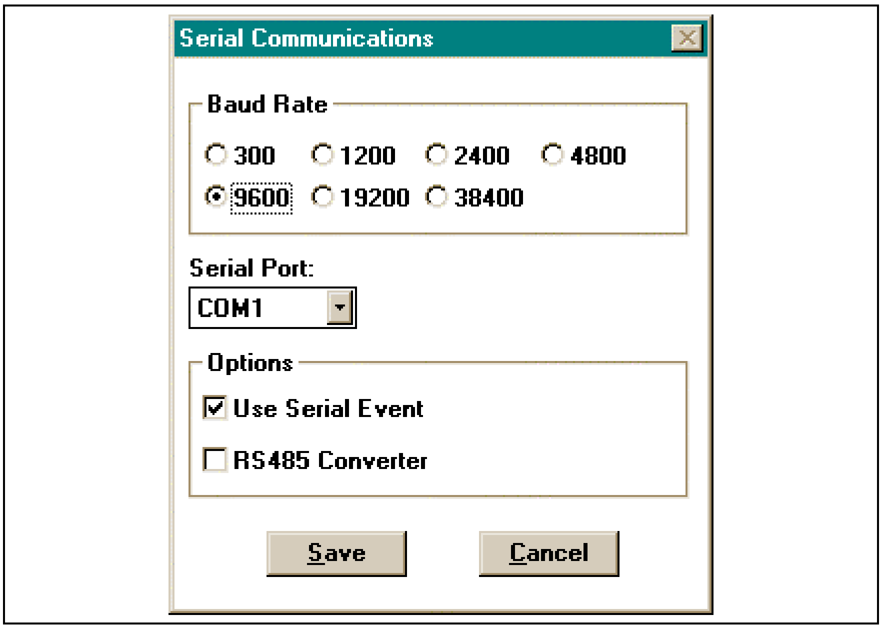
Intercept CLC Errors And Display	Checking this box will cause the server to intercept CLC error responses and displayed them in a message box. Request and poke transactions will return failure to the client application. Advise links will remain active, however they will return nothing until the error is resolved. The error response will be written to the error log file if that feature is enabled. If this box is not checked the error string will be returned to the client.
Make Error Messages System Modal	Checking this box will cause all server generated message boxes to have system modal attributes. This means that all applications will be suspended until the user responds to the message box. The window can not be forced to the background.
Log Errors To File	Checking this box will cause the server to log all server errors to a file. The current system date and time will be associated with each log entry. As a default this feature is not enabled.
View Log File	Pressing this button will cause the current error log file to be displayed in notepad.

DDE

Maximum Conversations	This is a static display of the maximum number of allowed DDE conversations as specified in the INI file. The server will refuse any DDE connection requests in excess of this value.
Maximum Advise Items	This is a static display of the maximum number of allowed DDE advise links as specified in the INI file. The server will refuse any requests for advise links in excess of this value.
Self Terminate If No Active Conversations	Checking this box will cause the server to close itself when the last DDE conversation with it has terminated. This is the default state.

Settings Menu - Serial Communication

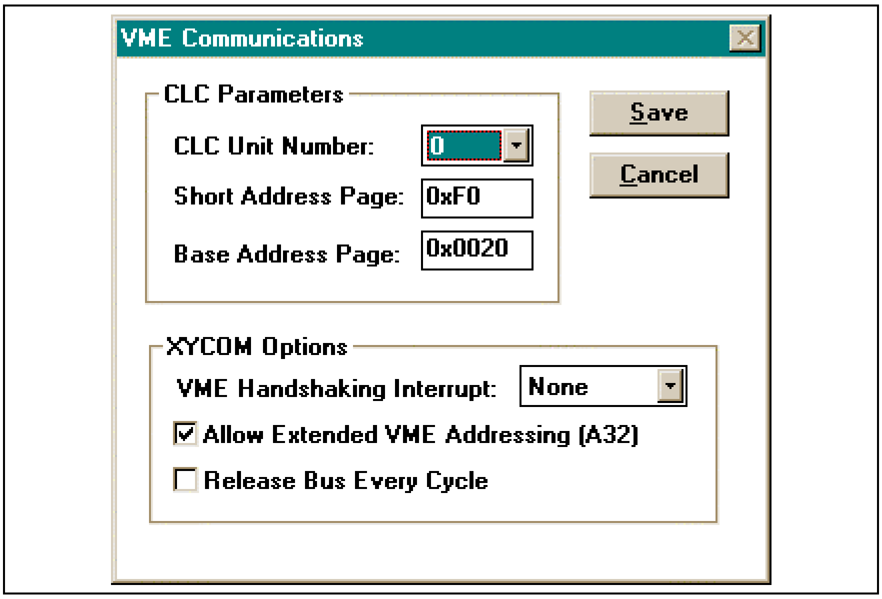
The Serial Communication dialog box allows the user to select the serial communication parameters the server will use. When this dialog box is open all communications are suspended. If changes are made to the configuration they will take affect when the "Save" button is pressed.



Baud Rate	Check the proper baud rate to use when communicating serially with a CLC card.
Serial Port	Select the serial communications port to use on the PC.
Use Serial Event	Checking this box causes Windows to notify the server when a completed message is in the receive queue. This will increase the number of serial messages sent over polling for a response. Slower computers may not be able to utilize this feature.
RS485 Converter (not available with TRANS 01-D)	This option should be used when an RS232 to RS485 converter is present. A delay will be inserted between messages which is equal to at least one character transmission at the selected baud rate. This is necessary to ensure that the CLC card has had sufficient time in which to turn the RS485 transmitter off and enable the receiver. Please note that the converter must toggle the transmitter and receiver automatically, and also that echo back must be disabled.

Settings Menu - VME Communication

The VME Communication dialog box allows the user to edit parameters which the server uses when talking over the VME bus using a XYCOM embedded PC. When this dialog box is open all communications are suspended. If changes are made to the configuration they will take affect when the “Save” button is pressed. The dynamic link library “XVME984.DLL” must be in the CLC directory or the windows path.



CLC Parameters

CLC Unit Number	The CLC unit number for the currently displayed data.
Short Address Page	The address page in short VME memory space where the selected CLC card resides.
Base Address Page	The address page in Standard or Extended memory space where the CLC’s shared RAM is located.

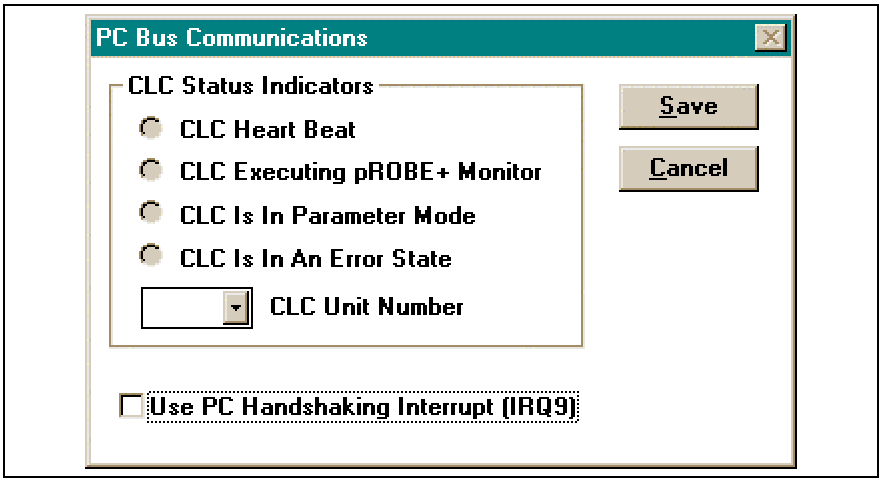
Note: The default server settings correspond to the default CLC control card settings and should not need to be altered.

XYCOM Options

VME Handshaking Interrupt	Select the VME interrupt which all CLC-V control cards should use to terminate a communication response. If this option is not used, the server will poll for a communication response every 55 milliseconds. Refer to your XYCOM owners manual to configure the computers BIOS to acknowledge the selected VME interrupt.
Allow Extended VME Addressing (A32)	Check this box if the XYCOM PC can support A32 addressing.
Release Bus Every Cycle	Check this box if the PC should release the VME bus after every cycle. This will increase communication overhead due to the additional bus arbitration cycles

Settings Menu - PC Bus Communication

The PC Communication dialog box allows the user to view CLC status indicators and set communication parameters. When this dialog box is open all communications are suspended. If changes are made to the configuration they will take affect when the “Save” button is pressed. The dynamic link library “CLC_P.DLL” must be in the CLC directory or the windows path.

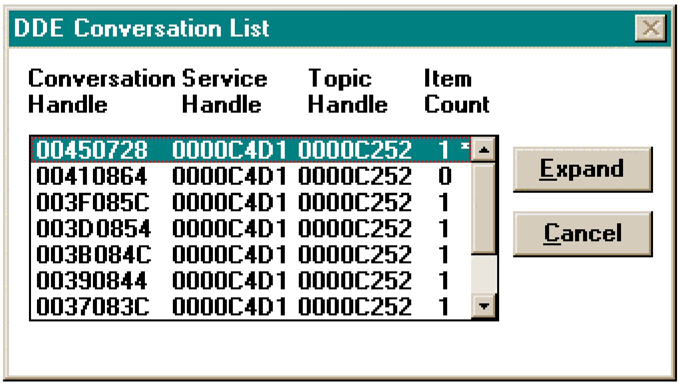


CLC Status Indicators

CLC Heart Beat	This indicator will blink indicating that the selected CLC control card is running.
CLC Executing pROBE+Monitor	This indicator will be marked if the selected CLC control card has faulted and is running the pROBE+ monitor.
CLC Is In Parameter Mode	This indicator will be marked when the selected CLC control card is in parameter mode.
CLC Is In An Error State	This indicator will be marked when the selected CLC control card is in an error state. Card parameter 122 will contain the specific error message.
CLC Unit Number	Use this pull down list to select the unit number to display the status indicators for.
Use PC Handshaking Interrupt (IRQ 9)	When selected, this option will force all CLC-P control cards to terminate communication responses with a PC interrupt (*IRQ 9*). Hardware jumper S5 must be inserted on the CLC-P card for this option to work properly. If this option is not used, the server will poll for a communication response every 55 milliseconds. **Note**: When using the interrupt option on the CLC-P control card, no other hardware devices may use IRQ 9.DDE Menu.

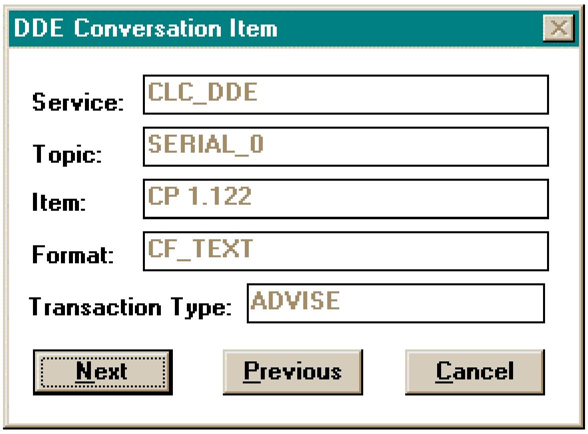
DDE Conversations

The DDE Conversations dialog box displays the **Conversation, Service and Topic Handles** for all of the current DDE conversations. The **Item Count** column shows the total number of active advise links, request transactions and poke transactions. Double click on a specific conversation entry in order to view the item transaction list. A second method is to select the conversation and then use the “expand” button. This dialog box is useful when creating client applications which talk to the CLC communications server.



DDE Conversation Item Dialog

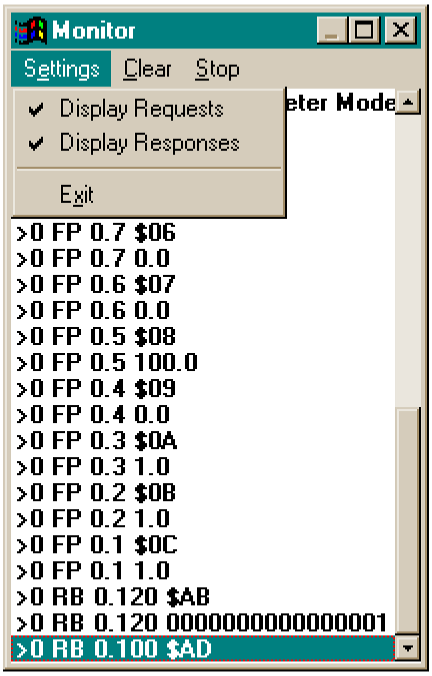
The DDE Conversation Item dialog box can be used to view the item transaction list for a conversation. The Service name, Topic string, Item string, clipboard Format and Transaction Type are displayed in text format. Use the “Next” and “Previous” buttons to cycle through the current list.



Communication Monitor

The DDE Communication Monitor displays all of the current DDE conversations. The monitor can display DDE requests and/ or responses depending the selection made under the *Settings* menu.

The active window builds a communications log of all DDE conversations that occur while the monitor is running. Selecting *Clear* will empty the log. Selecting *Stop* will stop the conversation monitoring and allow users to scroll through the log. The Monitor window can be resized to enlarge the active viewing area.



A.3 AT Modem Configuration Dialog

CLC_DDE supports communications with a telephone modem which uses the AT protocol. The server will initiate the modem link and instruct it to dial the desired number by sending standard AT commands. The AT Modem Configuration dialog box is automatically displayed when a DDE conversation which specifies the "AT_MODEM_x" topic is started. The box will again appear when the conversation is terminated. The dialog contains setup data and connection status. To initiate the modem connection first enter the baud rate, serial port and phone number. The next step is to select the "Connect" button and watch the status box. After the sending and receiving modems have connected press the "Cancel" button to close the dialog box.

The modems used for communication must respond to the AT protocol. CLC_DDE will initialize the sending modem and establish a connection with the receiving modem. The receiving modem should be configured in auto answer mode. The CLC card must be configured to the same baud rate as the receiving modem.

Baud Rate	Select the baud rate to use to talk to the sending modem.
Serial Port	Select the serial port to use to talk to the sending modem.
Telephone	Enter the complete phone number to dial including any numbers required to get an outside line. Placing a comma in the number will insert a delay.
Attempt To Connect On Start Up	Check this box if you wish CLC_DDE to automatically attempt a connection when a conversation is started. The telephone number is saved in the INI file. If this box is not check the user will need to select the "Connect" button.

A.4 SERVER Topic Name

The “SERVER” topic name allows a DDE client application access to CLC_DDE’s parameter set and status. The server will accept request and poke transactions. When accessing a parameter the client application should specify the section and entry names from the INI file. The two names must be separated by a pipe character (‘|’). When requesting status information the client should use “STATUS” as the section name (i.e. “STATUS|ErrorState”). RW = Read/Write RO = Read Only

Section: GENERAL	Response_Timeout	RW	1-900 Seconds	Message response time out.
	Relay_Timeout	RW	1-900 Seconds	Message time out when using VME pass-through.
	Communication_Retry	RW	0-255	Number of times to re-send a message.
	Suspend_Polling	RO	0 or 1	If 1 CLC_DDE status polling will be disabled.
	Display_CLC_Errors	RW	0 or 1	If 1 CLC_DDE will intercept & display CLC Errors.
	Log_Errors	RW	0 or 1	If 1 all server errors will be logged to the error file.
	Modal_Errors	RW	0 or 1	Displayed errors with the system modal attribute.
	Self_Terminate	RW	0 or 1	Close CLC_DDE when last conversation terminates.
	Monitor_List_Size	RW	1-500	# of entries in communication monitor window.
	Editor	RW	256 Characters	Name & path of text editor to use to display error log.
Section: SERIAL	Baudrate	RO	38400..300	Baud rate for serial connection to CLC card.
	Port	RO	1-4	COM port number to use for serial connection.
	Serial_Event	RW	0 or 1	Use serial event option to increase performance.
	RS485_Converter	RW	0 or 1	Activate RS485 adapter code.
Section: VME	Sustain_Bus	RW	0 or 1	Release every cycle option for XYCOM PC.
	A32_Addressing	RW	0 or 1	Use A32 addressing for XYCOM PC.
	VME_IRQ	RO	0-7	Number of VME IRQ to use (0 = disabled).

Section: AT_MODEM	Baudrate	RO	9600..300	Baud rate to use to communicate with the modem.
	Port	RO	1-4	COM port number the modem is on.
	Auto_Connect	RW	0 or 1	Initialize & connect on conversation connection.
	Phone	RW	50 Characters	Phone number to dial.
	Initialize_Script	RW	100 Characters	Script to initialize modem.
	Disconnect_Script	RW	100 Characters	Script to disconnect modem.
	Dial_Prefix	RW	50 Characters	Script to send to modem before phone number.
	Escape_Sequence	RW	50 Characters	Script to send modem to return to command mode.
Section: PC	PC_IRQ	RO	0 or 1	if 1 use PC interrupt for communications.
Section: DDE	Status	RO	200 Characters	CLC_DDE's status request item.
	Max_Conversations	RO	1-3274	Maximum allowed conversations.
	Max_Advise_Items	RO	1-3500	Maximum allowed advise items.
Section: STATUS	ErrorState	RO	0 or 1	If 1 CLC_DDE is issuing an error.
	ErrorText	RO	256 Characters	Error text message CLC_DDE is displaying.
	RequestState	RO	0 or 1	If 1 CLC_DDE is actively communicating.

B Direct ASCII Communication

B.1 Overview

The Indramat CLC / TRANS 01-D Motion Control can send and receive drive parameters, system parameters, user programs, and tables through its serial port. By using the text-based protocol described in this section, a wide variety of devices and programs can communicate with the CLC / TRANS 01-D. The protocol also supports ASCII PC ISA/ESIA and VME bus communication.

ASCII Conversion Chart

The following chart can be used as a reference for ASCII to Decimal to Hexadecimal conversions for PLC programming and to interpret the examples in this manual.

null	0	0	space	32	20	@	64	40	‘	96	60	Ç	128	80	á	160	A0	└	192	C0	α	224	E0
☺	1	1	!	33	21	A	65	41	a	97	61	ü	129	81	í	161	A1	┴	193	C1	ß	225	E1
☻	2	2	“	34	22	B	66	42	b	98	62	é	130	82	ó	162	A2	┬	194	C2	Γ	226	E2
♥	3	3	#	35	23	C	67	43	c	99	63	â	131	83	ú	163	A3	├	195	C3	π	227	E3
♦	4	4	$	36	24	D	68	44	d	100	64	ä	132	84	ñ	164	A4	─	196	C4	Σ	228	E4
♣	5	5	%	37	25	E	69	45	e	101	65	à	133	85	Ñ	165	A5	┼	197	C5	σ	229	E5
♠	6	6	&	38	26	F	70	46	f	102	66	å	134	86	ª	166	A6	╞	198	C6	µ	230	E6
•	7	7	‘	39	27	G	71	47	g	103	67	ç	135	87	º	167	A7	╟	199	C7	τ	231	E7
◘	8	8	(	40	28	H	72	48	h	104	68	ê	136	88	¿	168	A8	╚	200	C8	Φ	232	E8
○	9	9	)	41	29	I	73	49	i	105	69	ë	137	89	⌐	169	A9	╔	201	C9	Θ	233	E9
◙	10	A	*	42	2A	J	74	4A	j	106	6A	è	138	8A	¬	170	AA	╩	202	CA	Ω	234	EA
♂	11	B	+	43	2B	K	75	4B	k	107	6B	ï	139	8B	½	171	AB	╦	203	CB	δ	235	EB
♀	12	C	,	44	2C	L	76	4C	l	108	6C	î	140	8C	¼	172	AC	╠	204	CC	∞	236	EC
♪	13	D	-	45	2D	M	77	4D	m	109	6D	ì	141	8D	¡	173	AD	═	205	CD	φ	237	ED
♫	14	E	.	46	2E	N	78	4E	n	110	6E	Ä	142	8E	«	174	AE	╬	206	CE	ε	238	EE
☼	15	F	/	47	2F	O	79	4F	o	111	6F	Å	143	8F	»	175	AF	╧	207	CF	∩	239	EF
►	16	10	0	48	30	P	80	50	p	112	70	É	144	90	░	176	B0	╨	208	D0	≡	240	F0
◄	17	11	1	49	31	Q	81	51	q	113	71	æ	145	91	▒	177	B1	╤	209	D1	±	241	F1
↕	18	12	2	50	32	R	82	52	r	114	72	Æ	146	92	▓	178	B2	╥	210	D2	≥	242	F2
‼	19	13	3	51	33	S	83	53	s	115	73	ô	147	93	│	179	B3	╙	211	D3	≤	243	F3
¶	20	14	4	52	34	T	84	54	t	116	74	ö	148	94	┤	180	B4	╘	212	D4	⌠	244	F4
§	21	15	5	53	35	U	85	55	u	117	75	ò	149	95	╡	181	B5	╒	213	D5	⌡	245	F5
▬	22	16	6	54	36	V	86	56	v	118	76	û	150	96	╢	182	B6	╓	214	D6	÷	246	F6
↨	23	17	7	55	37	W	87	57	w	119	77	ù	151	97	╖	183	B7	╫	215	D7	≈	247	F7
↑	24	18	8	56	38	X	88	58	x	120	78	ÿ	152	98	╕	184	B8	╪	216	D8	°	248	F8
↓	25	19	9	57	39	Y	89	59	y	121	79	Ö	153	99	╣	185	B9	┘	217	D9	·	249	F9
→	26	1A	:	58	3A	Z	90	5A	z	12	7A	Ü	154	9A	║	186	BA	┌	218	DA	·	250	FA
←	27	1B	;	59	3B	[	91	5B	{	123	7B	¢	155	9B	╗	187	BB	█	219	DB	√	251	FB
∟	28	1C	<	60	3C	\	92	5C	|	124	7C	£	156	9C	╝	188	BC	▄	220	DC	^{n}	252	FC
↔	29	1D	=	61	3D	]	93	5D	}	125	7D	¥	157	9D	╜	189	BD	▌	221	DD	^{2}	253	FD
▲	30	1E	>	62	3E	^	94	5E	~	126	7E	₧	158	9E	╛	190	BE	▐	222	DE	■	254	FE
▼	31	1F	?	63	3F	_	95	5F	⌂	127	7F	ƒ	159	9F	┐	191	BF	▀	223	DF	del	255	FF

B.2 CLC Communication Protocol

The ASCII protocol format for the CLC / TRANS 01-D is designed so that all serial transmissions are similar in structure, facilitating simple coding/decoding routines. The protocol is the same for sending or receiving so that data may be easily handled and tracked.

All serial communications use the following standard protocol template. Information is classified using a three level system: command class, subclass, and data identifier.

```
>1 CS s.n 0123...CDEF $cs\r\n
||||||||| |         |  | |
||||||||| |         |  | |_ End of Message (i.e.,
cr/lf)
||||||||| |         |  |_  Two Digit ASCII Checksum
||||||||| |_________|_ Variable Length Data Field
|||||||||_ Number Within Set Data Identifier
||||||||_ ASCII period (0x2E)
|||||||_ Set Type Data Identifier
||||||_ optional ASCII space character (0x20)
|||||_ Command Subclass
||||_ Command Class
|||_ required ASCII space (0x20)
||_ Network Address (i.e. card position identifier)
|_ Start Character (0x3E)
```

Start Character The beginning of each message is identified by the ">" character (ASCII 62 decimal, 3E hex).

Network Address The network address can be used to support data transfer across a bus, or communication system, to multiple CLC / TRANS 01-D cards. The network address must be followed by an ASCII space character (0x20). An ASCII space (" ") character may be used to address the VME card containing the Host Communication serial port.

Data Identifier The Data Identifier field is a variable length field used to identify the data set being sent or requested. This identifier is in the format "s.n" or "s.n.x", where; "s"= the set identifier, may be a program handle, drive number, task ID, etc; and "n" = the numeric identifier used for items such as parameter numbers, table indexes and register numbers. The third field, called a "Step x" identifier, is used for parameter lists. No white space is allowed between the identifiers and the separating dot operators.

Variable Length Data This field contains the actual data being sent to or received from the CLC / TRANS 01-D. All subclasses have read and write capability. The same strings can be used for both responses and downloads.

Reading Data from the CLC / TRANS 01-D

To read data, the data portion of the string sent from the Host is empty. For example:

The Host system requests a Drive Status Message

```
>1 DP 1.95 \r\n
           |_ No data sent, requesting current data
```

The CLC / TRANS 01-D responds with the current status of the specified drive:

```
>1 DP 1.95 302 Position Mode Encoder 1 $cs\r\n
           |_ Data (status message)
```

Writing Data to the CLC / TRANS 01-D

To write data, send data in the data portion with the same starting protocol. Data received from the CLC / TRANS 01-D can be sent in the same format. The CLC / TRANS 01-D responds with an acknowledgment or an error message. For example:

The Host sends the CLC / TRANS 01-D the DDS drive Kv Parameter for drive 1:

```
>1 DP 1.104 1.00$cs\r\n
            |_ New data sent
```

The CLC / TRANS 01-D has successfully accepted the parameter, since no error message was returned:

```
>1 DP 1.104 $cs\r\n
          |_ No message: data stored successfully
```

Communication Errors

If there is a checksum error, a format error, or an error in the data sent to the CLC / TRANS 01-D or the drive, the CLC / TRANS 01-D returns an error string in the data field. The string begins with a "!" character, followed by an error code and a descriptive message. Communication error codes and messages are listed at the end of this section. For example:

```
>1 DP 1.104 !05 Greater than maximum value $cs\r\n
            ||  |_ Error message
            ||_ Error Code (decimal)
            |_ Error indicator "!"
```

Checksum

A CLC / TRANS 01-D checksum is sent as two ASCII hexadecimal digits preceded by an ASCII '$'. The checksum is optional when requesting data from the CLC / TRANS 01-D. When sending data to the CLC / TRANS 01-D the checksum is required, unless it is disabled in the checksum parameter.

To compute the checksum, add the hexadecimal ASCII values of all of the characters before the '$', including the starting ">" character. Then add the most significant digit of the checksum to the two least significant digits. Negate ('+/-' on a calculator) this value to form the two's complement. The checksum transmitted to the CLC / TRANS 01-D is the 2 least significant digits of this number. This is the same checksum method used with the Indramat CLM Positioning Control and Station Operator Terminal (SOT). For example:

Checksum on >1 AP 1.1 2

```
      3E hex
      31
      20
      41
      50
      20
      31
      2E
      31
      20
     +32
     ------
     222    (sum)

      22  (two least significant digits)
     + 2  (add two)
     ------
      24   (two's complement) - Checksum = 24 (DC in hexadecimal)
```

End of Message

An ASCII carriage return (CR = 13 in decimal or 0d hexadecimal) and linefeed (LF, 10 decimal or 0a hex) combination is used for terminal compatibility. This document uses the notation '\r'(return) and '\n'(new line), as used with the C programming language, interchangeably with the CR LF notation. The CLC / TRANS 01-D always sends a CR LF combination, but will accept either a single LF or a CR LF from the Host device.

Backspaces and White spaces

The ASCII backspace character (8 decimal or hex) erases the previous character from the CLC / TRANS 01-D's serial buffer except at the start of a message. This is useful for editing strings entered at a terminal. Also, any white space character (tab or space) can be used as a delimiter in strings. White spaces between fields or at the end of a message are discarded by the CLC / TRANS 01-D.

Numeric Data Formats

The CLC / TRANS 01-D sends numeric data in ASCII parameter-specified units and scaling format. The format of floating point data depends on the data's use and how and where it is stored. Floating point data of fixed precision (e.g., drive data) uses fixed resolution. The resolution of data stored on the CLC / TRANS 01-D card (i.e., local or global variables) depends on the storage precision used; 32 or 64-bit.

Floating point data that is too large or small to be printed in decimal format is represented in scientific notation. *Hexadecimal data* is sent and received with an '0x' prefix. *Binary data* is represented as a 16 digit string of ASCII "1" or "0" characters. For example:

- ***Floating point position data**:* 0.0100 123.4567 -12.0000 12.3e+16 *(resolution = 0.0001 units)*
- ***Integer data**:* 0 1000 -10
- ***Hexadecimal data:*** 0x12AB 0x1234ABCD
- ***Binary data:*** 0000111100001111

Format of Data Sent to the CLC / TRANS 01-D

Any resolution can be used for data sent to the CLC / TRANS 01-D. Numbers may be padded with zeros or spaces at either end as a visual formatting aid when entering data from a terminal. Padding applies to data identifiers as well as the data field.

The resolution of the data stored on the CLC / TRANS 01-D is the resolution of the data the CLC / TRANS 01-D sends to the Host on request. Floating point numbers may also be sent in scientific notation.

B.3 Command Classes/ Subclasses

The tables below list the command class identifier and the subclass identifier for each of the available subclasses within the command class.

Parameters

Command Class	Command Subclass
A - CLC / TRANS 01-D Axis Parameters	A - Attributes
	B - Block List Parameter
	D - Lists/Tables
	H - Upper Limit
	L - Lower Limit
	P - Parameter Data
	T - Name Text
	U - Units Text
C - CLC / TRANS 01-D Card Parameters	(Same subclasses as CLC / TRANS 01-D Axis Parameters)
D - SERCOS Drive Parameters	(Same subclasses as CLC / TRANS 01-D Axis Parameters)
T - Task Parameters	(Same subclasses as CLC / TRANS 01-D Axis Parameters)

Variables

Command Class	Command Subclass
F - Floating Point Variables	P - Data
G - Global Integer Variables	T - Text Label

Program Communication

Command Class	Command Subclass
B - TRANS 01-D	A - CTA 10 Parameter Set
	F - User Program

I/O Registers

Command Class	Command Subclass
R - I/O Registers	B - Current State in Binary
	C - Forcing State Change
	D - Current State in Decimal
	E - Erase all Forcing Masks
	F - Forcing Mask
	S - Binary Forcing State
	X - Current State in Hexadecimal

Input/Output Registers

B.4 Drive and CLC / TRANS 01-D Parameters and Subclasses

The CLC / TRANS 01-D System/Axis, Task, and Drive parameters follow the same general format. The subclasses are data elements (data, name, units, etc.) as specified in SERCOS. CLC / TRANS 01-D parameters include system configuration data that is entered during the configuration of the system, as well as continuously updated system status values and messages that monitor system operation.

- CLC / TRANS 01-D card parameters are accessed using parameter set C1.
- CLC / TRANS 01-D axis parameters use the parameter sets A1 through A4.
- DDS drive parameters are accessed using parameter sets D1 through D4.
- CLC / TRANS 01-D task parameters use the parameter set Task C.

Additional information on the parameter sets can be found in the section on CLC / TRANS 01-D Parameters in this manual, and in the DDS-2 Drive and SERCOS manuals.

For example:

```
>1 CP 1.122 $cs\r\n
   || | |_ number
   || |_ set: Axis, Task, or Drive Address
   ||_ subclass: Parameter data, name Text, High or
Low limits, Attributes
   |_ class: type of parameter
```

Parameter Data Subclass

The P subclass specifies the actual parameter data, sent and received in ASCII format according to its attributes (decimal, hexadecimal, text, etc.).

Name Text Subclass

The T subclass provides the name of the parameter, provided as a text string in the language selected for the CLC / TRANS 01-D. The ability to specify actual text for the parameter name permits the host software to be independent of CLC / TRANS 01-D or Drive parameter updates.

Units Text Subclass

The U subclass returns the system units, "in" (inches) or "mm" (millimeters), as an ASCII text string.

Upper Limit, L: Lower Limit Subclasses

The H and U subclasses return the range of permissible data entry that is set by the DDS drive or CLC / TRANS 01-D for numeric data. Limits are always returned as floating point type data.

Attribute Subclass

The A subclass request a hexadecimal longword (16 bits). Bits in this longword are set for data type and scaling according to the SERCOS specification. The attribute data is available for informational purposes, or may be used to detect if a SERCOS parameter is a command or a status value.

Parameter Lists Subclasses

The D subclass is used to request lists of parameters. Since new versions of DDS drives and the CLC / TRANS 01-D may expand or change the parameter sets, lists of all parameters and all required parameters can be uploaded by the Host program. Parameters such as the DDS oscilloscope function also use variable-length lists. Parameter list formats are described later in this section.

SERCOS Parameter Sets

The SERCOS specifications allow a digital drive to have both Standard and Product Specific Parameter Sets. The Standard parameters are accessed by the parameter number (E.G., 1.95). Product Specific Parameters can be accessed using a 'P' prefix, which adds 32768 to the parameter number. For example, Parameter P-0-0005 can also be accessed as "1.32773" or "1.P5".

Examples: The Host requests the name, data, and units for Drive 1 parameter 123:

```
>1 DT 1.123 \r\n     ;request drive 1 text name for
parameter 123

>1 DP 1.123 \r\n     ;request drive 1 parameter
data

>1 DU 1.123 \r\n     ;request drive 1 units of
measurement
```

The DDS drive responds, through the CLC / TRANS 01-D:

```
>1 DT 1.123 Feed Constant $cs\r\n     ;the name is
"Feed Constant"

>1 DP 1.123 6.2832 $cs\r\n            ;the
parameter value is 6.2832

>1 DU 1.123 mm $cs\r\n                ;the
measurement units are in mm
```

B.5 Parameter Lists

Some CLC / TRANS 01-D functions and parameters, and SERCOS parameters, are implemented as variable-length data lists. Lists of parameters are used to determine all the parameters present on the DDS drive or CLC / TRANS 01-D card, and to classify or request parameters by function or type. The DDS-2 oscilloscope function data tables are accessed as parameter lists. Sequence numbers are used to list each parameter in the list, allowing other transmissions to the CLC / TRANS 01-D during the list upload.

List Parameter Command:

```
>1 xD a.x.n \r\n
   || | | |_ Step: Sequence number (0 to length+1)
   || | |_ Number: Parameter number
   || |_ Set: Axis, drive, or task number
   ||_ Subclass: Command, List Parameter or Table
   |_ Class: A=axis, C= card, D=drive, T=task
```

Listing a Parameter

To request a parameter list, the Host sends the list parameter command with the sequence number = 0 to the CLC / TRANS 01-D. The CLC / TRANS 01-D responds with the sequence number replace with a count of the number of items in the list. The Host then requests each list item sequentially, beginning with sequence number = 1. The sequence number is then incremented by one and the request repeated until all needed items or the entire list has been received.

The CLC / TRANS 01-D requires parameter list sequence numbers to be incremented sequentially. If an error occurs, the request for the current list item may be immediately repeated, allowing the Host to request missed data and ensuring that the data is sent in the proper order. The CLC / TRANS 01-D will respond with an error if sent an invalid sequence number.

At the end of the upload, the Host must signal the CLC / TRANS 01-D to close the list by sending a sequence number equal to the length of the list + 1.

If required, more than one parameter list can be active at one time. The Host must always close a list when it is finished since each open list uses CLC / TRANS 01-D resources.

Example of Parameter List request:

1) The Host requests a List Parameter:

```
>1 DD 1.17.0 \r\n       ;Parameter S-0-17
```

The CLC / TRANS 01-D responds with length of the list:

```
>1 DD 1.17.0 180 $cs\r\n      ;180 parameters in
list
```

2) The Host requests the first parameter in the list:

```
>1 DD 1.17.1 \r\n
```

The CLC / TRANS 01-D responds with the first parameter:

```
>1 DD 1.17.1 44 $cs\r\n
```

3) The Host requests the second parameter in the list:

```
>1 DD 1.17.2 \r\n
```

The CLC / TRANS 01-D responds with the second parameter:

```
>1 DD 1.17.2 104 $cs\r\n
```

.
.
.

180) The Host continues to sequentially request items in list.

181) The Host closes the list by sending a sequence number = the list length+1

```
>1 DD 1.17.181 \r\n
```

The CLC / TRANS 01-D acknowledges the end of the list:

```
>1 DD 1.17.181 !19 List is finished $cs\r\n
```

Parameter List Block Transfer

Classes: C, A, D, T

Subclass: B

Data Type: List of space-delimited strings with ASCII integers or floats

For faster communications, the CLC / TRANS 01-D can send and receive parameter lists 16 elements at a time. Drive parameter lists allowing block transfer include cam tables, oscilloscope data, and any other non-text parameter list. The ‘B’ subclass works similar to the ‘D’ parameter list subclass, but instead of sending one item at a time, 16 elements are sent.

```
>u xB a.s.n \r\n
 || | | |_Step: Sequence number (0 to length+1)
 || | |_ Number: Parameter number
 || |_Set: Axis, drive, or task number
 ||_Subclass: Command, List Parameter or Table
 |_Class: A=axis, C= system, D=drive, T=task
```

Requesting a Block List Parameter

To request the start of a list, the Host sends sequence number 0 to the CLC / TRANS 01-D. The CLC / TRANS 01-D responds with the number of elements in the list.

The number of steps in the list is equal to ((elements +15)/ 16). The Host requests this number of steps from the list until the list is finished.

The data in the response strings is space delimited. Floating point and decimal values are scaled the same as when they are printed individually.

If the number of elements in the list is not evenly divisible by 16, the CLC / TRANS 01-D will fill the last response string with space-delimited zeros for each remaining element. If the data cannot be printed in less than 220 characters, the error message “!55 List or string is too long” is issued.

The CLC / TRANS 01-D requires that step numbers be incremented by one, but any previous step may be repeated. This allows the host to request any missed data and ensures that the data is sent in the proper order. For example, the sequence (1, 2, 3, 3, 4) is valid, but (1, 2, 3, 5) is not. If an invalid step number is sent, the CLC / TRANS 01-D responds with an error.

At the end of the upload, the Host must close the list by sending a sequence number equal to (length of list + 1). The Host must always close a list when it is finished since each new list uses CLC / TRANS 01-D resources.

Example: 0) Host requests a list parameter using block transfer

>1 DB 1.32840.0 \r\n ;Parameter P-0-72 (cam table 1)

CLC / TRANS 01-D responds with the number of elements in the list:

>1 DB 1.32840.0 1024 $cs\r\n ;1024 points in cam table = 64 steps

1) Host requests first 16 elements in list:

>1 DB 1.32840.1 \r\n

CLC / TRANS 01-D responds with first 16 elements:

>1 DB 1.32840.1 0.0 0.0015 0.002 0.01 0.015 --11 more elements…-- \r\n

2) Host requests elements 17-32:

>1 DB 1.32840.2 \r\n

CLC / TRANS 01-D responds with next 16 elements

>1 DB 1.32840.1 20.0 20.0015 -- 14 more elements -- \r\n

3-64) Host continues to request items in list as above.

65) To close the list, host sends sequence number (steps+1)

>1 DB 1.32840.65 \r\n

CLC / TRANS 01-D acknowledges end of list:

>1 DB 1.32840.65 !19 List is finished $cs\r\n

Sending a Block List Parameter

To start sending a block list, the Host sends sequence number 0 to the CLC / TRANS 01-D, along with the number of elements to be sent. The number of steps in the list is equal to ((elements +15)/ 16). The Host sends this number of steps from the list until the list is finished.

The data in the strings must be space delimited. The host can send the data with any resolution, with or without decimal point.

If the number of elements in the list is not evenly divisible by 16, the host must fill the last string with space-delimited zeros for each remaining element.

If the number of elements in the string is less than 16, the CLC / TRANS 01-D responds with the message “!54 List or String is too short”. If the length of the data portion of the string sent to the CLC / TRANS 01-D (minus protocol header, checksum, and terminator) is greater than 220 characters, the CLC / TRANS 01-D responds with the message “!55 List or string is too long”.

At the end of the download, the Host must close the list by sending a sequence number equal to (length of list + 1). The string for this step must include at least one data element. For simplicity, the host can send 16 space-delimited zeros.

Example: 0) Host starts sending a list parameter using block transfer

>1 DB 1.32840.0 1024 $cs\r\n ;Parameter P-0-72 (cam table 1)

;1024 points in cam table = 64 steps

CLC / TRANS 01-D responds with an acknowledgment:

>1 DB 1.32840.0 $cs\r\n

1) Host sends first 16 elements in list:

>1 DB 1.32840.1 0.0 0.0015 0.002 0.01 0.015 --11 more elements…-- $cs\r\n

CLC / TRANS 01-D acknowledges:

>1 DB 1.32840.1 $cs\r\n

2-64) Host continues to send items in list as above.

65) To close the list, host sends sequence number (steps+1), with string having at least one zero.

>1 DB 1.32840.65 0.0 $cs\r\n

CLC / TRANS 01-D acknowledges end of list:

>1 DB 1.32840.65 !19 List is finished $cs\r\n

B.6 User Program Variables

The CLC / TRANS 01-D maintains a unique set of integer and floating point variables for each user program. An additional set of integer and floating point global variables is not related to a specific program and may be accessed by any program or device on the bus. User variable data can be exchanged between the Host and the CLC / TRANS 01-D using the same format as the floating point and integer parameters. The current value of a variable is obtained and changed using the P subclass.

Format:

```
>1 IP h.xx
   || | |_ number: variable table index number
   || |_ set: Program handle
   ||_ subclass: P=Send/receive Data, T=print text
label
   |_ class: I=Integer Variable, F=Float Variable
             G=Global Integer,   H=Global Float
```

The user program handle provides access to the variables for any CLC / TRANS 01-D resident user program. Use the program handle "0" to access the active program’s variables.

’P’: Data

Type: Floating Point ("F") or Integer ("I")

Data in a CLC / TRANS 01-D variable table is accessed by supplying the class (I or F), and the numeric index (e.g. 1 for I[1] or 15 for F[15]) of the desired variable. The variable number "0" is used to request a count of the variables used by the selected program.

'T': Label Text

Type: String

The text label for any variable can be obtained by using the T subclass. If no text label is found, an ASCII space (" ") character is returned. Since the program labels are fixed when the program is compiled, labels cannot be changed with this command.

Examples: The Host requests the number of integer variables used by program 1:

```
>1 IP 1.0 \r\n
```

The CLC / TRANS 01-D responds with:

```
>1 IP 1.0 20\r\n    ;20 variables
```

The Host sends floating point data, 123.456 to Variable F12 for the program with handle 2:

```
>1 FP 2.12 123.456 $cs\r\n
```

The CLC / TRANS 01-D acknowledges with:

```
>1 FP 2.12 $cs\r\n
```

The Host requests the label name for Variable I20 for the current program:

```
>1 IP 0.20 \r\n
```

The CLC / TRANS 01-D returns the name "count":

```
>1 IP 0.20 count\r\n
```

B.7 Input/Output Registers

The Host system may read the CLC / TRANS 01-D's input and output registers at any time; including control, status, and programmable registers. The CLC / TRANS 01-D's axis, system, and task status registers are normally read-only, and are only changed by the CLC / TRANS 01-D I/O mapper executive task or the register forcing commands (see below). Setting I/O registers directly (using the RB, RX and RD commands) has the lowest priority of all I/O access methods.

Directly accessing I/O registers should be done with caution. The CLC / TRANS 01-D is a multitasking system, and as such the potential for I/O contention always exists between user tasks, the Host communication, the I/O Mapper, and the I/O subsystem. It is the programmer's responsibility to anticipate contention problems and synchronize accesses to data between asynchronous CLC / TRANS 01-D tasks when necessary.

The forcing commands (RM, RF, RC and RS) are provided primarily for debugging purposes. Forcing commands should be used with extreme caution since they can be used to override the state of system control registers, and have higher priority than the CLC / TRANS 01-D's I/O mapper or Host direct access commands.

The requirement for a checksum may be disabled by parameter. This practice is not suggested. It results in no communication error checking of data sent to the CLC / TRANS 01-D that may effect safe operation of the system.

I/O Register Access (RB), (RX), (RD)

Input registers are accessed using "R(data type)" commands and a register specifying index number within the range 1 to 200. The current contents of the register may be read as a 16-bit binary number (command "RB"), a 4-digit hex number (command "RX"), or a decimal integer number (command "RD").

Example:

```
>1 Rt 0.nnn $cs\r\n
    | | |_ register number
    | |_ set ID, always 0 for I/O registers
    |_ subclass: type or format (B=binary,
D==decimal, X=hexadecimal)
```

I/O Register Read

Example: Host requests the contents of register 1 in binary:

```
>1 RB 0.1 \r\n
```

The CLC / TRANS 01-D responds with:

```
>1 RB 0.1 0001001000110010 $cs\r\n
          |               |_ least significant bit
          |_ most significant bit
```

The checksum is optional when reading data from the CLC / TRANS 01-D.

Sending a "0" as the register index number returns the number of registers in the current system.

I/O Register Write

The Host may send a value to a CLC / TRANS 01-D I/O register in hexadecimal ("RX"), binary ("RB"), or decimal ("RD") using the same format as an I/O read with the addition of a data field and checksum.

Example:

```
>1 RX 0.121 0x0040 $cs\r\n
    | | |   |_ 16 bit hex word to write
    | | |_ I/O register number 121
    | |_ always 0 for I/O registers
    |_ read/write to register in hex
```

Set Current I/O State with Mask (RM)

The RB, RD and RX commands affect every bit of the destination I/O register, the new data word replaces the old word. RM allows you to specify a mask in addition to data bits, limiting the I/O register bits that are changed.

The most significant 16 bits in this 32-bit word provide the mask selecting the bits that may be changed. A "1" enables change, "0" masks any change. The least significant 16 bits changes the state of the I/O register bits. If RM is used to read the register, the CLC / TRANS 01-D returns the state of all bits. See the notes above for changing I/O register bits.

Format:

```
>1 RM 0.2 0x00600040
            |  ||__|_ 16 bit word of new bit states
            |__|_ 16 bit mask of bits to change
```

Example:

```
>1 RM 0.2 0x00600040 ;bit 6 is turned on, bit 7 off
```

RM is a single use, independent equivalent of setting a mask with an RF command, then setting the actual I/O bit states with an RC or RS command. Since RM contains its own mask it does not affect the forcing mask set with RF. See the RF, RC and RS commands below.

I/O Forcing Selection (RF)

The forcing selection (RF) and forcing state (RC and RS) commands allow the Host to selectively force the state of individual bits in the I/O registers. Forcing commands take priority over the CLC / TRANS 01-D I/O mapper and I/O devices.

The forcing remains in effect until the mask for each forced bit is cleared, or until there is a time-out error on the serial port. When the forcing state changes for bits in a CLC / TRANS 01-D control register, all edge detection is reset.

If a bit in the 16-bit forcing mask is set to 0, the corresponding bit in the I/O register is controlled by the I/O Mapper and physical I/O. If the forcing mask bit is set to 1, the I/O register bit is forced by the Host "RC" or "RS" command.

The data format of the "RF" 16-bit forcing mask word is always binary.

Example:

```
>1 RF 0.2 0000000001001000
                   |__|_ bits 4 and 7 are forced
bits and are
                         controlled by the Host all
other bits
                         are controlled by the
physical I/O and
                         the CLC / TRANS 01-D I/O
Mapper
```

I/O Forcing State Change (RC)

The most significant 16 bits in this 32-bit word select which bits in the I/O register may be affected, and the least significant 16 bits changes the states of those bits. If it is read, it returns the state of all bits.

The data format of the "RC" state change word is always a 32-bit hexadecimal longword.

Format:

```
>1 RC 0.2 0x00600040
            |  ||__|_ 16 bit word of new bit states
            |__|_ 16 bit mask of bits to change
```

Example:

```
>1 RC 0.2 0x00600040
              |   |_ bit 6 on, bit 7 off
              |_ allow changes to bits 6 and 7
```

I/O Binary Forcing State (RS)

The "RS" command is used to read and write the state of the forcing bits for the selected register. If bits are to be affected, the desired bits in the I/O register must have had forcing enabled by a forcing mask set with the "RF" command.

The data format of the "RS" 16-bit forcing state word is always binary.

Example:

```
>1 RS 0.2 0000000100000001
                 |_______|_ bits 1 and 9 are turned
on, all other
                            bits turned off if the
bits have
                            forcing enabled by an
"RF" command
```

Erase All Forcing Masks (RE)

This command sets all forcing masks and states to zero and returns the I/O system to normal control. The command only takes effect at the time that it is sent.

Caution should be used when using this command. The I/O registers are directly affected and clearing the mask(s) may cause immediate unwanted motion in the system.

The data format of the "RE" command is ASCII integer.

Example:

```
>1 RE 0.1 1
        | |_ set to 1 to erase forcing masks
        |_ always ’0.1’
```

B.8 Communication Error Codes and Messages

Error Code	Description
!01 SERCOS Error Code#xxxx (xxxx=Error code)	This is the code set in the data status word of the DDS-2 drive if SERCOS communication is invalid. Call Indramat Service if this error occurs.
!02 Invalid Parameter Number	The requested or sent parameter does not exist on the CLC / TRANS 01-D or the drive, or the format of the parameter is incorrect.
!03 Data is Read Only	The data in this parameter may not be modified.
!04 Write Protected in this mode/phase	The data in this parameter can not be written in this mode or communication phase. Switch into parameter mode (phase 2) to enter the parameter.
!05 Greater than maximum value	The parameter exceeds the maximum allowed value.
!06 Less than minimum value	The parameter is less than the minimum allowed value.
!07 Data is Invalid	Parameter data is invalid, or the format of the parameter is invalid. See the DDS or CLC / TRANS 01-D Parameter Descriptions.
!08 Drive was not found	The requested drive was not found on the SERCOS ring.
!09 Drive not ready for communication	The requested drive or the SERCOS ring has not been initialized.
!10 Drive is not responding	The drive did not respond to a service channel request. Check system diagnostics for the state of the SERCOS ring.
!11 Service channel is not open.	When switching between initialization phases, data from the drive is momentarily invalid, and this message is sent instead of the requested data.
!12 Invalid Command Class	A serial port command is invalid or not supported at this time.
!13 Checksum Error: xx (xx= checksum that CLC / TRANS 01-D calculated)	The CLC / TRANS 01-D detected an invalid or missing checksum in data that was sent to it. As a debugging aid, the checksum that the CLC / TRANS 01-D calculated on the incoming data is also sent with this message.
!14 Invalid Command Subclass	A serial port command option is invalid or not supported.
!15 Invalid Parameter Set	The parameter set number (task or axis) is invalid.
!16 List already in progress	An attempt has been made to start a parameter or program list that is already in progress.
!17 Invalid Sequence Number	The sequence number of a parameter or program list is invalid or has been sent out of order.
!18 List has not started	A parameter or program list has not been initiated (i.e. sequence number was sent before list was started).
!19 List is finished	This is an acknowledgment that a parameter or program list is complete. It does not indicate an error.
!20 Parameter is a List	This parameter is a variable-length list, and its data cannot be displayed as a normal parameter.
!21 Parameter is not a List	Only Variable-Length List parameters can use the Parameter List sequence.

Error Code	Description
!22 Invalid Variable Number	The variable mnemonic was not 'I' or 'F', or the variable number is greater than the maximum number of variables allocated.
!23 Insufficient program space	This message is sent after the CLC / TRANS 01-D receives a "P W" program header if not enough contiguous memory is left on the CLC / TRANS 01-D to store the program. Other programs may need to be deleted or their order rearranged. Check system parameters C1.91, C1.92 and C1.93 for CLC / TRANS 01-D memory status.
!24 Maximum number of files exceeded	The CLC / TRANS 01-D allows up to 10 programs resident in the CLC / TRANS 01-D. This error message is sent when the CLC / TRANS 01-D receives a "PW" program header and there are already 10 programs stored on the CLC / TRANS 01-D. One of the CLC / TRANS 01-D resident program files must be deleted to make room to download the program.
!25 Invalid program header	The format of the program header sent to the CLC / TRANS 01-D is invalid, or this command is not available for reading or writing.
!26 Checksum Error in Program	This message is sent at the end of a download if the checksum of the data does not match the checksums sent in the program or program header.
!27 Invalid Program Handle	The format of the handle is incorrect, or this command is not available for reading or writing.
!28 Function not Implemented	The function is not implemented in this version of the CLC / TRANS 01-D.
!29 File not Found	A program corresponding to the requested program handle was not found (e.g., the program is not resident in the CLC / TRANS 01-D).
!30 Invalid I/O Register	The I/O register mnemonic is invalid or a register number greater than the maximum number of registers was sent.
!31 Invalid Table Index	The ABS, REL, or EVT table name was incorrect, or the index number was greater than the maximum number of points or events.
!32 Communication Error 32	This error is not used by the CLC / TRANS 01-D at this time.
!33 Invalid Data Format	The format of the data received by the CLC / TRANS 01-D is invalid (e.g., non-digits are sent in a decimal number).
!34 Active program can't be deleted	The active program cannot be deleted at any time.
!35 Parameter mode is required	The action requested can only be performed in Parameter Mode.
!36 Invalid Event Number	The event number selected in the ABS or REL point table is out of the range of the total number of events.
!37 Invalid Event Function	The function name selected in the event table does not exist on the CLC / TRANS 01-D card or is not defined as an event function.
!38 Program file version mismatch	The version of the file system on the card does not match that of the downloaded file. Upgrade to the latest versions of the Visual Motion compiler and CLC / TRANS 01-D executive.
!39 Can't activate while program running	A new program cannot be activated unless all user tasks are stopped.

Error Code	Description
!40 No programs are active	No programs are active on the CLC / TRANS 01-D card. Download a program to the card.
!41 System Error: pSOS #XXXX	This is an internal CLC / TRANS 01-D system error. Call Indramat Service for assistance.
!42 Mapper String DD: invalid operator	An invalid Boolean operator was found in I/O Mapper String "DD" when it was sent to the CLC / TRANS 01-D.
!43 Mapper String DD: too many operations	Sending the string "DD" exceeded the maximum number of Boolean operations allowed by the CLC / TRANS 01-D I/O mapper.
!44 Mapper String DD: invalid register	A register in Mapper String "DD" exceeds the maximum number of registers or is 0.
!45 Mapper String DD: invalid bit or mask	The bit number or mask sent in string "DD" exceeds 16 bits.
!46 Mapper String DD: register is read-only	An assignment to a read-only register or bit was made in I/O mapper string "DD" (e.g., attempting to write to a CLC / TRANS 01-D status register).
!47 Invalid Unit Number	The unit number (second character in string) is not a number between ’1’ and ’F’ or an ASCII space character.
!48 VME Bus Error	A VME bus error occurred while communicating to another card in pass-through mode through the serial port.
!49 VME Communication Handshake Error (D)	The card addressed by the unit number in pass-through mode does not exist or its parameters are not configured properly. Change the unit number to correspond to a card in the rack or set it to a space. (No longer issued on CLC / TRANS 01-D-D.)
!50 Invalid Download Block	The block sent during a program download is incorrect in length or is not in hexadecimal format.
!51 Unit D: Invalid VME Base Address Page	The VME base address page parameter is set to an invalid address for the indicated VME unit number.
!52 Axis Disabled	The parameter set for the requested axis does not exist. Either this axis is disabled or the CLC / TRANS 01-D does not support this number of axes.
!53 Waiting for service channel	When switching between drive initialization phases, data from the drive is momentarily invalid. This message is sent instead of the requested data. This message will also be issued whenever a service channel transaction cannot be completed. Continue to retry the message until a valid response is returned.
!54 List or String is too short	The text string or parameter list is smaller than the minimum length allowed by the CLC / TRANS 01-D or the drive, or the size of a value does not match the attributes sent from the drive.
!55 List or String is too long	The text string or parameter list exceeds the maximum length allowed by the CLC / TRANS 01-D or the drive, or the size of a value does not match the attributes sent from the drive.
!56 PC Communication Handshake Error	The CLC / TRANS 01-D/P is not responding to an ASCII message. Check the address configuration on both the PC (config.sys and system.ini) and the CLC / TRANS 01-D/P (address jumper switches).
!57 Mapper String D: string space is full	The CLC / TRANS 01-D’s memory that was allocated for I-O mapper strings (8KBytes) has been exhausted. Optimize the mapping program so that it fits into memory.

Error Code	Description
!58 Cannot store cam: already active for axis D	Cam data cannot be changed unless no axes are currently using it. Deactivate the cam for axis ‘D’, then send the cam again.
!59 SERCOS handshake/busy time-out	This is an internal error generated by the SERCOS ASIC. Change modes or reset the card. If it happens again, call Indramat Service.
!60 Executable program is too large (ddK)	The executable portion of the user program downloaded to the CLC / TRANS 01-D exceeds the maximum limit, which is indicated in the message (‘dd’) in kilobytes. Optimize the program and download it again, or update the firmware to a version that has a larger program limit.
!61 System Memory Allocation Error	The dynamic memory space on the CLC / TRANS 01-D has been exhausted. Call Indramat Service for assistance.
!62 Cam X data is < 0 or greater than 360	All values in the x-column (right hand column) of the cam file sent to the CLC / TRANS 01-D must be between zero and the modulo value of the master.
!63 X-Column does not start at 0 or end at 360	In the cam file sent to the CLC / TRANS 01-D, the first point must be zero and the last point must be the modulo value of the master. Check the beginning and end of the cam file.
!64 Not supported in user program file version 1.1	The requested feature is not present in the file version of the user program from which the data was requested or sent. To use this feature, a compiler upgrade is necessary.
!65 Sequencer: invalid sequence (D)	The sequence number (D) is zero or is greater than the allocated maximum number of sequencers for this program.
!66 Sequencer: invalid step (D)	The sequencer step number (D) is zero or is greater than the allocated maximum number of steps for this program.
!67 Invalid function number (D)	The function number (D) selected for a sequencer step is invalid or refers to a function that does not exist on the card.
!68 Function D not accessible in a step	The function referred to with the number (D) cannot be entered in a sequencer step. It needs to be declared accessible by the sequencer in the user program.
!69 Too many functions are used (D)	The total number of functions used by all steps exceeds the number (D) allocated for the program in the data sizing instruction, or the number of functions used in a step exceeds the number of functions remaining. Reduce the number of functions used or allocate more function slots in the data sizing instruction.
!70 Maximum steps per sequence exceeded (D)	The number of steps in a sequence exceeds the number (D) allocated for the program in the data sizing instruction.
!71 Maximum functions per step exceeded (D)	Up to (D) functions can be used in one sequencer step. This is a CLC / TRANS 01-D system limit, which in version GPS-02.00 is 100.
!72 Program does not include a PLS	PLS data was requested from a program that does not support the Programmable Limit Switch function or does not have any PLS’s configured.
!73 Invalid ABS or REL point index (D)	Point D is zero or is greater than the allocated maximum number of points for the selected point table

Error Code	Description
!74 Error in command execution	A procedure command set in the CLC / TRANS 01-D or drive parameter has not been successfully completed.
!75 Comm. port buffer overflow	The serial port receive buffer has overflowed. In current versions of the CLC / TRANS 01-D, this buffer is 512 bytes. To avoid this error, the host must communicate in half duplex or use XON-XOFF handshaking correctly.
!76 Invalid Block	This message is reserved for the TRANS 01-D version of the CLC / TRANS 01-D. See the documentation for this version.
!77 Can't save sequencer while it is running	Sequencer data can only be save while the program is not running, or while no user tasks are running a sequencer.
!78 Service channel in use	The SERCOS service channel is being used by a user program task or by a CLC / TRANS 01-D internal process, and has suspended the transmission of a list or text string. See the description of parameter C-0-0010, bit 12.
!79 PID block number does not exist	This error is issued when the selected PID block is not initialized in the user program.

C Interbus Fieldbus Interface

C.1 Introduction

This section describes the Interbus-S fieldbus interface of Indramat's CLC-D control card.

Topology

The serial fieldbus interface is operated via a plug-in card as a fieldbus slave. The firmware of the plug-in card implements the bus level for a slave coupling and exchanges data with the CLC via an internal dual port ram.

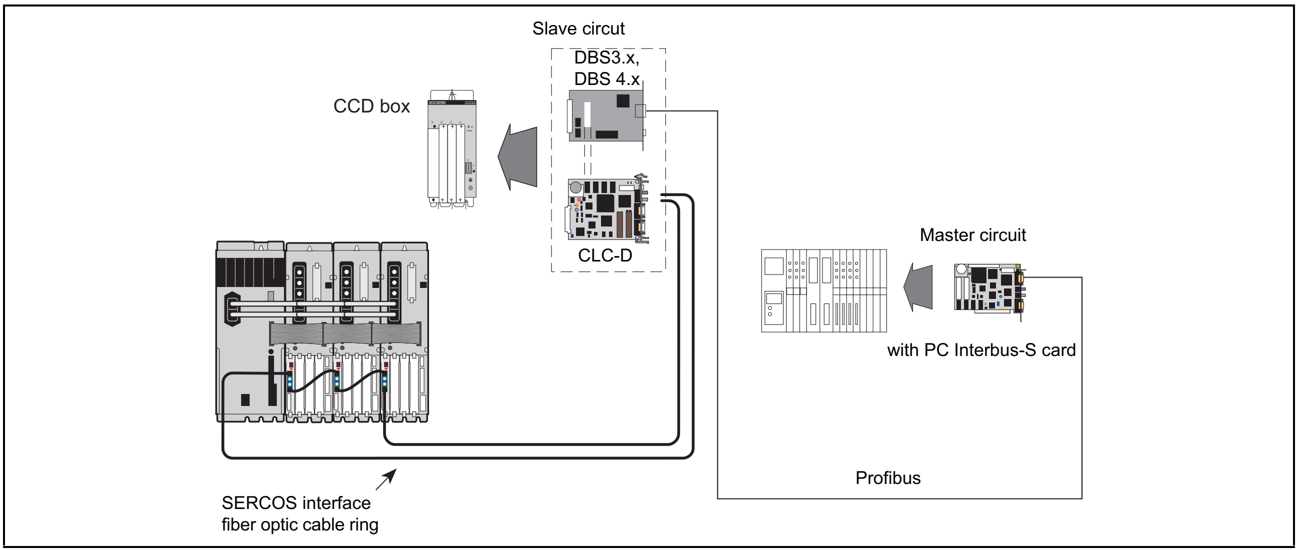


Figure C-1: Topological Structure of Master/Slave Communication with Interbus-S

Data Objects

The data exchange is conducted by means of the data objects assigned to the fieldbus interfaces. Several data objects for 2 or 4 byte data are defined to which the master directly and cyclically has access in real time.

A transmission of longer data blocks, e.g., parameter lists, and accessing the CLC mode can only occur acyclically via data exchange objects. These four objects are byte arrays of various lengths, via which data can be exchanged.

The fieldbus interface supports two separate channels to transfer data:

Process Data Channel

The process data channel is used for the exchange of data blocks in real time. The exchange of data takes place on the CLC in the SERCOS cycle. Thus, "max" {SERCOS cycle, bus cycle}', i.e., the maximum of bus and SERCOS cycle, determines the updating cycle for the process data.

The input and output data of the process data channel are written by the fieldbus master into configuration objects 6000 and 6001 (see section "Process Data Channel," page C-1). With these objects, the master determines which data object is to be cyclically exchanged. Parameters or I/O objects identified by the master must be specified in the CLC in the relevant configuration lists.

Note: The CLC is still presently supporting a write access of parameter objects via the process data channel.

Communications Channel

The communications channel supports the acyclic transmission of data where time is not a critical factor. All data objects defined for the fieldbus can be taken into consideration as per the determined data access.

Parameter objects specified in the CLC in the relevant configuration lists can thus be accessed directly via the data objects.

Accessing the data of any parameter, list or the CLC mode is conducted indirectly via data exchange objects. The data is transmitted with a data storage protocol.

Note 1: The CLC is still presently supporting a write access of parameter objects via the process data channel.

Note 2: It is not permitted to write access data already written into the process data channel.

List of Data Accesses via Various Data Channels

The fieldbus interface makes it possible to:

- write access parameters via the process data channel
- directly read access parameters configured in the CLC via the communications channel
- transmit parameters via the communications channel using data exchange objects
- transmit digital inputs/outputs via the process data channel
- directly access digital inputs/outputs via the communications channel
- switch from operating into parameterization mode via the communications channel using data exchange objects
- read access diagnostic objects via the process data channel
- directly read access diagnostic objects via the communications channel

C.2 Process Data Channel

Default Configuration of the Process Data Channel of the Fieldbus Card

The default configuration supports applications on the CLC-D with TRANS 01-D firmware. This is the only Interbus-S configuration possible with Trans 01-D firmware, up to and including version 5 VRS.

Default Configuration of the Process Data Channel of the Fieldbus Card

The process data channel occupies five words on the bus (in both data directions). These five words on the bus are assigned to the following objects:

	Word 1:	Word 2:	Word 3:	Word 4:	Word 5:
OUT:	com-Out	5FB1	5FB2	5FB3	5FF1
IN:	com-IN	5F91	5F92	5F10(H)	5F10(L)

Table C-1: Default assignment of the process data channel with Interbus-S

The user can only use four of the five bus words directly. Word 1 is used for the communications channel even if it is not being used. In other words, it is always reserved for the communications channel.

Note 1: Word 1 can be disabled by setting bit 12 of DD word 5FF1 to 1.

Note 2: These usable process objects are assigned on the CLC card.

The master is informed, via the user's id code, of the number of words on the bus and about a possible support of the communications channel.

Data Direction

The bus specification fixes the data direction.

- Data direction **input**
  The data transmission from slave to master is data direction input.
- Data direction **output**
  The data transmission from master to slave is data direction output.

Application-Specific Configuration of the Process Data Channel

The user can determine each desired configuration of the process data channel himself using the objects for configuration of this channel.

Process Input Data Description

Object 6000

This object illustrates the structure and thus the number of words and their assignment to objects (indices) for process input data.

Using "read" and "write" of the communications channel, the user can read the existing structure and determine a new configuration for the process input data by inputting a new structure.

Note: The documentation on the fieldbus specific slave assemblies - DBS03.1 - describes the communication channel services supported.

The master uses this configuration for its knowledge about the position of the individual objects on the bus.

Note: A maximum of 5 words per data direction are configured on the bus with the fieldbus option cards even if the specific fieldbus permits longer project data blocks. The first word is always used for the communications channel.

Process Output Data Description

Object 6001 The structure of the process output data is stored in this object. The current structure and thus the assignment on the bus can be read with this object via the communications channel. The user can change the process data channel by entering a new structure.

Data Direction

The bus specification fixes the data direction.

- Data direction **input**
  The data transmission from slave to master is data direction input.
- Data direction **output**
  The data transmission from master to slave is data direction output.

Process Data Input Description with Object 6000

The process data input description is stored in object 6000. This description applies to all fieldbuses as per InterBus-S specification profile 12. The structure of this object is depicted in the default configuration example.

The Basic Structure

The length of object 6000 is determined by the maximum number of words on the fieldbus without taking the communications channel into account.

The bus length in bytes (hex) is entered in the first byte of object 6000.

The entries for each byte on the bus follow in rising order. The object number (index) is entered for each byte as two byte data. A byte for a sub-index is also left available. This byte is always zero for the fieldbus assemblies.

If an object is made up of several bytes (standard word structure for fieldbus assemblies is always at least 2 bytes), there must then always be an entry in the first byte for the object number. The assignment of object numbers to the remaining bytes uses the sub-index (zero).

Example: Default configuration in InterBus-S

	Word 1:	**Word 2:**	**Word 3:**	**Word 4:**	**Word 5:**
OUT:	com-Out	5FB1	5FB2	5FB3	5FF1
IN:	com-IN	5F91	5F92	5F10(H)	5F10(L)

Table C-2: Default assignment of the process data channel in InterBus-S

Byte no.	Value	Definition
1	0x08	Bus length of the process data chan.in bytes
2	0x5F	1st byte on bus; **5F**91
3	0x91	1st byte on bus; 5F**91**
4	0x00	Sub-index of object 5F91 (always 00)
5	0x00	2nd byte on bus; object 5F91 (Word)
6	0x00	2nd byte on bus; object 5F91 (Word)
7	0x00	Sub-index of object 5F91 (always 00)
8	0x5F	3rd byte on bus; **5F**92
9	0x92	3rd byte on bus; 5F**92**
10	0x00	Sub-index of object 5F92 (always 00)
11	0x00	4th byte on bus; object 5F92 (Word)
12	0x00	4th byte on bus; object 5F92 (Word)
13	0x00	Sub-index pf pbject 5F92 (always 00)
14	0x5F	5th bytes on bus; **5F**10
15	0x10	5th byte on bus; 5F**10**
16	0x00	Sub-index of object 5F10 (always 00)
17	0x00	6th byte on bus; object 5F10 (D-Word)
18	0x00	6th byte on bus; object 5F10 (D-Word)
19	0x00	Sub-index of object 5F10 (always 00)
20	0x00	7th byte on bus; object 5F10 (D-Word)
21	0x00	7th byte on bus; object 5F10 (D-Word)
22	0x00	Sub-index of object 5F10 (always 00)
23	0x00	8th byte on bus; object 5F10 (D-Word)
24	0x00	8th byte on bus; object 5F10 (D-Word)
25	0x00	Sub-index of object 5F10 (always 00)

Table C-3: Default data contents of object 6000 in InterBus-S

Process Data Output Description with Object 6001

The process data output description is stored in object 6001.

This description contains a copy of the position and the number of the output words on the bus. The structure is the same as the process input data description in object 6000.

The description relates to the following default configuration.

Example: Default configuration in Interbus-S

	Word 1:	Word 2:	Word 3:	Word 4:	Word 5:
OUT:	com-Out	5FB1	5FB2	5FB3	5FF1
IN:	com-IN	5F91	5F92	5F10(H)	5F10(L)

Table C-4: Default assignment of the process data channel in Profibus

Byte no.	Value	Definition
1	0x08	Bus length of the process data chan.in bytes
2	0x5F	1st byte on bus; **5F**B1
3	0xB1	1st byte on bus; 5F**B1**
4	0x00	Sub-index to object 5FB1 (always 00)
5	0x00	2nd byte on bus; object 5FB1 (Word)
6	0x00	2nd byte on bus; object 5FB1 (Word)
7	0x00	Sub-index to object 5FB1 (always 00)
8	0x5F	3rd byte on bus; **5F**B2
9	0xB2	3rd byte on bus; 5F**B2**
10	0x00	Sub-index to object 5FB2 (always 00)
11	0x00	4th byte on bus; object 5FB2 (Word)
12	0x00	4th byte on bus; object 5FB2 (Word)
13	0x00	Sub-index to object 5FB2 (always 00)
14	0x5F	5th byte on bus; **5F**B3
15	0xB3	5th byte on bus; 5F**B3**
16	0x00	Sub-index to object 5FB3 (always 00)
17	0x00	6th byte at bus; object 5FB3 (Word)
18	0x00	6th byte at bus; object 5FB3 (Word)
19	0x00	Sub-index to object 5FB3 (always 00)
20	0x5F	7th byte at bus; **5F**F1
21	0xF1	7th byte at bus; 5F**F1**
22	0x00	Sub-index to object 5FF1 (always 00)
23	0x00	8th byte at bus; object 5FF1 (Word)
24	0x00	8th byte at bus; object 5FF1 (Word)
25	0x00	Sub-index to object 5FF1 (always 00)

Table C-5: Default data contents of object 6001 in Interbus-S

Monitoring the Process Data Channel of the Fieldbus Cards

Data transmission via fieldbuses is generally error free. If data is transmitted from master to slaves, it is subjected to extensive checks before the slave assumes it as valid and makes it effective. Data detected as faulty during transmission (hamming distance = 4 with all supported fieldbuses) is not relayed to the CLC-D. This, of course, also applies to data sent to the master.

Behavior with Bus Failure

It is possible that the fieldbus completely fails. This can be due to a break in the cable or a slave failure. In this case, the data entered once would be retained until the next update. This could lead to application-related problems.

The fieldbus assemblies are therefore equipped with a monitor. These are watchdog terminals which make a very specific response caused by a bus failure possible.

Watchdog Function

Via object

6003 PD monitoring span

the time can be set in [ms] once the error reaction is set after the fieldbus fails.

Note: When setting PD monitoring span it should be taken into account that fieldbus cycles can fail under normal operating conditions.

Error Reaction with Bus Failure:

The fieldbus board enables the setting of two error reactions for the process data channel. These can meet various demands.

Via object

6004 error reaction PD channel

the following options are available:

Output Data Remain Intact: If object 6004 is set to value 0x0000, the output data remains intact even with a bus failure. In other words, the previously output data remains effective. A bus failure is signaled in the status register of the CLC-D.

Output Data Cleared: It makes sense for critical applications, in particular those in which motion is controlled by the output signals, to be able to clear the outputs.

If the value 0x0001 is entered in object 6004, then the output data will be cleared if the fieldbus fails.

Note: All data is entered only dynamically in the objects. After the board is switched off, the default setting once again becomes effective if the user does not secure the data of the objects before hand. (See documentation on the fieldbus specification of slave board DBS03.x or DBS4.4).

Multiplex Channel

The Interbus-S fieldbus interface to the TRANS 01-D has a 5 word wide process data channel. This means that standard applications can be processed without a problem.

With some applications it is, however, necessary, to relay the data of numerous axes to the master. This would considerably exceed the data width of a slave in the fieldbus ring.

It is for this reason that a multiplex system has been installed in the process data channel for the transmission of data for the fieldbus interface. The multiplex system permits different axis data within the process data channel in both data directions. This data is on a preset index coming from the master in the form of current real time data.

Only the base objects of the multiplex system are configured in the process data channel. Permissible base objects are all elements of the data blocks. The options in the base objects can be dynamically selected via an index that operates as an object offset within the multiplex system, as the current objects of the process data channel.

The depth of the multiplex channel is preset by a master by the TRANS 01-D.

Example of an Object of the Multiplex Channel

The master configures object 5F10 in the process data channel as the input object. With the cyclical setting of the index, the master can now visualize the object 5F10. This object can, for example, be the actual positions of an axis.

C.3 Communications Channel

Direct Access to Data Objects

There is direct access to all objects defined on the fieldbus except for data exchange objects via the communications channel. It must thus be noted that:

- it is not possible to write access data objects already written into via the process data channel
- write access to parameter objects are, as with the process data channel, presently not being supported
- write access to CLC inputs, not accounted for in the I/O logic (see section "I/O logic"), may be permitted but have no effect
- read access to CLC outputs, not accounted for the I/O logic (see section "I/O logic") are permitted but only supply a base load value
- read access to parameter objects not configured on the CLC are permitted but only supply a base load value
- read access to parameter objects configured on the CLC as drive parameters, but not in the drive telegram as well (see parameter S-0-0016) are not supported as a PCP object.

C.4 Diagnosis on the Fieldbus Interface

There are a total of three 16 bit objects available for diagnostic handling on the fieldbus interface as well as an internal 16 bit field and a diagnostic object. The CLC (objects 5FF5 and 5FF6) and the fieldbus card (internal 16 bit field and object 5FF2) each update two of these 16 bit fields.

Using these objects, the fieldbus master can detect the status of the fieldbus interface of the CLC and the CLC can generate its diagnostic.

Objects 5FF2, 5FF5 and 5FF6 are single 16 bit objects that can also be configured in the process data channel.

Note: For the master to be able to recognize the validity of the process data or interfere in the communications channel at any time, at least diagnostic object 5FF5 should be configured in the process data channel.

Object 5FF0 is an array of all three 16 bit objects and the internal 16 bit field. It makes a diagnosis possible with just one data access and offers information about the states (5FF2 and 5FF5) as well as fault codes (5FF6 and the specific fieldbus problem) of the slave boards.

Note: Object 5FF0 ("Diagnostic fieldbus') can only be accessed via the communications channel because it is an array object.

Bit Assignment of Diagnostic Objects 5FF5 and 5FF6

Bit field 'Status CLC-D' (object 5FF5)

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
x15	x14	x13	---	---	---	---	---	---	---	---	---	---	---	x1	x0

x0 Status bit for the **Process data channel (PD channel):**

= 0 --> the process data channel is OK, the data are valid,

= 1 --> there is no error pending for the process data channel, the data are invalid. A precise diagnosis is possible with the help of the 8 lower bits of the bit field 'fault code CLC-D' (object 5FF6).
No interference bit for the PD channel is set here. The data are thus not valid because the slave is (still) not ready.

x1 Status bit for the **Communications channel:**

= 0 --> the communications channel is OK, the previous data access was successful.

= 1 --> No error has occurred in the communications channel (data transmission error).
A more precise diagnosis can be obtained with the help of the 8 higher bits of bit field 'fault code CLC-D' (object 5FF6).

x13 - x15 **Fieldbus interface specification:**

Bit 15	Bit 14	Bit 13	
0	0	1	Interbus-S
0	1	0	Profibus
0	1	1	still free
1	0	0	still free
1	0	1	still free
1	1	0	still free
1	1	1	still free
0	0	0	still free

Table C-6: Fieldbus interface specification

--- Free status bit.

Rexroth Indramat

Bit Field 'Fault Code CLC-D' (Object 5FF6)

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
---	---	---	y4	y3	y2	y1	y0	---	---	---	x4	x3	x2	x1	x0

The interference bits in object 5FF6 are broken down in 8 bits each for the process data and the communications channel. The lower 8 bits are for the process data channel, the higher for the communications channel.

The interference bits for the process data channel are written first:

The errors in the process data channel are bit coded and show a faulty configuration of the process data or multiplex channels (MUX-). The slave recognizes them by means of the initialization or after a reconfiguration and keeps them pending until a new correct configuration as no sensible cyclical data exchange is possible.

x0 Interference bit for **support of data objects**:

= 0 --> All data objects are supported in the process data channel

= 1 --> at least one data object is not available via the process data channel

x1 Interference bit for **access to data objects**:

= 0 --> access to the data objects if correct

= 1 --> at least one data object has been incorrectly accessed (read or write access not permitted)

x2 Interference bit for **object length of process data:**

= 0 --> the lengths of the process data channel fixed by the master agree with the lengths specified for the fieldbus

= 1 --> the lengths of the process data channel fixed by the master do not agree with the length of at least one data object specified for the fieldbus

x3 Interference bit for **configuration as fieldbus and SERCOS object**:

= 0 --> all drive parameters are configured in the relevant drive telegram

= 1 --> at least one drive parameter is not configured in the drive telegram
Possible causes are:
- one configuration list has been incorrectly parameterized
- drive parameter not transmitted to the drive telegram in configured operating mode (see A-0-0001, A-0-0003 and A-0-0070)
- data object set in the process data channel does not belong to this SYNAX application.

x4 Interference bit for **multiplex channel length**:

= 0 --> the length of the multiplex channel set in object 5FFE ('Start-offset multiplex channel') is permissible

= 1 --> the length of the multiplex channel set in object 5FFE ('Start-offset multiplex channel') is not permissible. This state occurs, for example, if the start object and the length of the multiplex channel have been selected so that at least one multiplex object falls into a different object class.

The interference bits for the communications channel are described below. They remain pending until the next correct access to a data object.

If the diagnostic object 5FF6 ('fault code CLC-D') is not configured in the process data channel, then note the following when diagnosing problems.

Note: After an error in communications channel, immediately read diagnostic object 5FF6 ("fault code CLC-D") before further diagnosis to avoid clearing interference bits with next valid access.

---

y0 Interference bit for **support of data objects:**

= 0 --> the data object is supported in the communications channel

= 1 --> the data object is not available via the communications channel

y1 Interference bit for **Access to data objects**:

= 0 --> the access to data object was correct,

= 1 --> incorrect access to data object (write request cannot be read

y2 Interference bit for **Write-Request with data exchange objects**:

= 0 --> access to data exchange object is correct

= 1 --> a write request is still active via a data exchange object meaning that a new access is not permitted. This conflict can only occur in a multi-master system.

y3 Interference bit for **Read-Request with data exchange objects**:

= 0 --> access to data exchange object is correct

= 1 --> the data for the read request via data exchange object have not yet arrived
Possible causes are:
- interference in slave system
- faulty receiver address in data telegram (see point y4),
- the read request was too early (e.g., with P-0-0072).

In the last case, the read request must be repeated.

y4 Interference bit for **Data content in data exchange object**:

= 0 --> the data telegram has been sent to the correct recipient

= 1 --> the receiving address in the data telegram protocol does not agree with the physical bus address. The telegram is discarded. No reaction telegram can be read (see point y3).

--- Free interference bit

Bit Assignment of Diagnostic Objects 5FF0 and 5FF2

Bit Field 'Status Fieldbus' (Object 5FF2)

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
x15	---	---	---	---	---	---	---	---	---	x5	x4	x3	---	x1	x0

x0, x1 Status bit for **internal (DPR) communication** of the fieldbus slave:

Bit 1	Bit 0	
0	0	a reset has been conducted on the DPR
0	1	the DPR has only been initialized by the fieldbus card
1	0	the DPR is complete, i.e., the CLC has also initialized it
1	1	the internal communication of the fieldbus slave, especially the watchdog function, is not working correctly

Table C-7: Status bit for the internal (DPR) communication of the fieldbus slave

x3 Status bit for the **active bus capabilities of** the fieldbus slaves:

= 0 --> the fieldbus slave is not (yet) ready for data exchange

= 1 --> the fieldbus slave can actively participate on the bus

x4 Status bit for **communications channel:**

= 0 --> the communications channel can not (yet) be used

= 1 --> the communications channel is available

x5 Status bit for **Reconfiguring the process data channel**:

= 0 --> the process data channel is being reconfigured on the fieldbus card at this moment

= 1 --> the process data channel on the fieldbus card is configured

x15 Status bit for the **Multiplex channel**

= 0 --> the multiplex channel is not (yet) active

= 1 --> the multiplex channel is active

--- Free status bit.

Bit Field 'Diagnostic Fieldbus' (Object 5FF0)

This object is made up objects 5FF2, 5FF5, 5FF6 and the following internal 16 bit field described:

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
x15	x14	x13	---	---	---	---	---	x7	x6	x5	x4	x3	x2	x1	x0

x0 - x7 Interface specific **Fault code**:

x13 - x15 Specification of the **fieldbus interface**:

Bit 15	**Bit 14**	**Bit 13**	
0	0	1	Interbus-S
0	1	0	Profibus
0	1	1	still free
1	0	0	still free
1	0	1	still free
1	1	0	still free
1	1	1	still free
0	0	0	still free

Table C-8: Fieldbus interface specification

--- Free interference bit.

Note: The single 16 bit fields are transmitted into the following series:
5FF6 ('fault code CLC-D'), 5FF5 ('status CLC-D'), internal bit field (see above), 5FF2 ('status fieldbus').

CLC-D Diagnosis

The CLC-D diagnoses the following interference and faults which can occur in conjunction with the fieldbus interface and can then prevent a continuous bus communication:

Interference on the Fieldbus

This includes all errors that could lead to the setting of a bus-specific interference bit in object 5FF0 ('fault code fieldbus', additional 16 bit field). The CLC generates the diagnostic

"**no communication via the fieldbus is possible**"

The diagnostic message can be cleared via system input _E:C01.03 ("CLC error clear external communication").

Communications Interference between CLC and the Interface Card of the Fieldbus

If both firmware versions of the CLC-D and relevant interface card are incompatible, then no internal communication of both slave boards is built up. In this case, the diagnostic

"**non-supported firmware version of the interface card**"

is generated. Progression of the CLC is prevented till a permitted firmware version is installed on the interface card. This error cannot be cleared.

In both cases, fieldbus communications is interfered with so that the master cannot clear it. A control of the SYNAX application is not possible.

Note: The master recognizes all of these errors and eliminates them. A diagnostic message on CLC-D is not needed.

C.5 Interbus-S Slave Boards DBS03.1 or DBS 4.1

Applications

The InterBus-S slave boards DBS03.1 enables the integration of CLC-D control board into an InterBus-S system. The board supports the real-time process data channel with up to 16 words. It enables a non-cyclical data exchange between master and slave via the PCP channel of InterBus-S.

This enables the transmission of parameters and data blocks of CLC-D control board as well as parameters of the drive controllers connected to this control.

The parameterization of InterBus-S board DBS03.1 is also supported.

To achieve the highest degree of flexibility that is possible while applying the object structure of board DBS03.1, the user can freely configure both the process data channel and the PCP.

The PCP channel occupies one word of the process data channel in the bus.

A reconfiguration of the process data channel is only possible via the PCP channel - that is the communications channel of the InterBus-S.

Note: The use of a master circuit of the 4th generation is recommended**!**

Function Overview

The DBS03.1 board has the following features:

- InterBus-S slave supports PCP 2.0
- long-distance bus circuit with galvanically-isolated interfaces
- freely-configurable process data channel 1 of 16 word data width at the bus
- intrinsic microprocessor for support of the PCP protocol and object management
- process data channel and PCP channel monitoring
- data exchange for CLC-D control board via dual port RAM
- hardware and software synchronization using the CLC-D control board
- LED diagnostics display integrated into the front panel in accordance with InterBus-S guidelines
- implementation of an object structure to simplify access to variables and parameters belonging to the control board and drive
- Upload / download function via 4 arrays of 16 to 128 bytes are used (PCP service).

Interbus-S Interface

The InterBus-S interface of board DBS03.1 is constructed as a long-distance bus circuit and corresponds to InterBus-S certification standards and requirements.

To guarantee European standards for EMC safety the board on the bus side has been entirely galvanically decoupled. To maintain resistance to interference, the user may only use those connectors on the front that guarantee complete shielding and are laid out so that there is absolutely no contact between incoming and outgoing connectors.

As per standard DIN E 19258 the InterBus-S is equipped with a DBS03.1 with 9-pin D-sub-miniature connector for an incoming and outgoing bus.

- X 40 incoming bus 9-pin D-sub-miniature connector
- X 41 outcoming bus 9-pin D-sub-miniature bushing

Note: The plug-in connector configuration corresponds to DIN E 19258 standards.

Based on the bus structure of the InterBus-S, all participants of an InterBus-S ring must be switched on to guarantee the bus function. The failure of a participant means a breakdown of bus operations.

Note: If it is desirable to maintain bus functions with the DBS board powered down, then DBS 4.1 InterBus-S board with repeater function must be used.

Eight LEDs are on DBS03.1 board for the purpose of diagnosing the InterBus-S function. It is located on the front panel. The definition can be found in section "DBS03.1 Diagnostic," page C-20.

DBS03.1 Board Hardware

Front View of DBS03.1

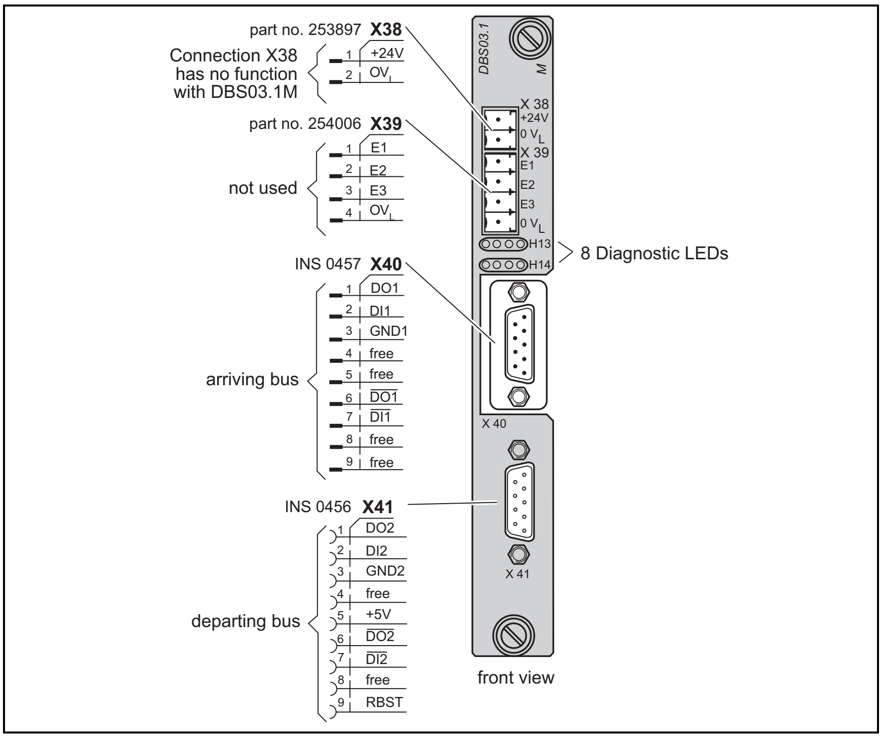


Figure C-2: Front view of the DBS03.1

DBS03.1 Structure

The DBS03.1 board is conceived as a plug-in group which is directly inserted into the control board. Once it has been screwed onto the control board, with three guide pins, it becomes a unit with the CLC-D which can only together be inserted in the drive or a separate CCD card rack.

Note: Additional boards can be inserted onto DBS03.1 into the system. This should be noted when dismantling or removing the card rack!

Power is supplied (+5V) by the drive or CCD card rack via a connector on the back. Signals are always exchanged via the connector to the CLC-D.

The interface to the CLC-D is a 68020 bus. Only one DBS03.1 board can be switched together with the CLC-D.

Note: The DBS03.1 board may not be operated together with a Profibus slave board DPF05.1.

The DBS03.1 has the following interfaces:

Interface to the Drive or CCD Card Rack

This interface is used to supply power to the DBS03.1 board, if the CLC-D does not supply the power.

Interface to CLC-D or Other Card Racks

Information is exchanged between CLC-D and other card racks via this interface. The interface is a 68020 bus interface with partial coding of the address space so that other card boards can also be mounted.

External Inputs

There are three hardware outputs (+24V) on the DBS03.1. This inputs can only be used with the CLC-D if this is supported by the appropriate firmware. The signal states at this input are transmitted from the InterBus-S (on/off state) to the CLC-D. They can also be queried by the InterBus-S master via the PD or the PCP channel.

Note: The external inputs are not supported by the CLC-D**!**

External Power Source

The DBS03.1 board has **no** InterBus-S repeater function which is maintained by an external power source if the DBS board is removed from the internal power source.

Note: If a repeater function is needed with an external power source, then a DBS4.1 board must be used.

Serial Interface

A serial interface is on the DBS03.1 board for testing. The user cannot access it. This interface needs a special firmware version.

Interbus-S Long-Distance Bus, Incoming Interface

This is the InterBus-S standard interface as per DIN E 19258 for long-distance bus participants via a 9-pin D-sub-miniature connector. The interface is completely galvanically isolated. It contains a duplex circuit based on an RS 485. It couples with the previous participant of the InterBus-S ring.

Interbus-S Long-Distance Bus Outgoing Interface

This is the InterBus-S standard interface as per DIN E 19258 for long-distance bus participants via a 9-pin D-sub-miniature bushing. The interface is completely galvanically isolated. It contains a duplex circuit based on an RS 485. A strobe signal to detect a relaying InterBus-S is included.

Signal Configuration X40 Connector on Interbus-S, Incoming Bus

X40	Signal	Designation	X40	Signal	Designation
1	DO 1	Out RS 485	6	/DO 1	Out RS 485
2	DI 1	IN RS 485	7	/DI 1	IN RS 485
3	GND 1	reference potential	8	---	Not used
4	---	Not used	9	---	Not used
5	---	Not used	-	---	---

Table C-9: Signal configuration X40 connector on InterBus-S, incoming bus

Plug-in connector: 9-pin D-sub-miniature connector strip.

Signal Configuration X41 Connector on Interbus-S, Outgoing Bus

X40	Signal	Designation	X40	Signal	Designation
1	DO 2	Out RS 485	6	/DO 2	Out Rs 485
2	DI 2	IN RS 485	7	/DI 2	IN RS 485
3	GND 2	reference potential	8	---	not used
4	---	not used	9	RBST	remote bus control
5	+5V 2		-		

Table C-10: Signal configuration X41connector on Interbus-S, outgoing bus

Plug-in connector: 9 pin D-sub-miniature bushing strip

Signal Configuration X3 Connector, External Inputs

X3	Designation	Input voltage high	Input voltage low
1	E1	+16 V... +32 V	-0.5 V ... +8 V
2	E2	+16 V... +32 V	-0.5V ... +8 V
3	E3	+16 V... +32 V	-0.5 V ... +8 V
4	$0V_L$	reference potential 0V	reference potential 0V

Table C-11: Signal configuration X3 connector, external inputs

Signal Configuration X4 Connector on CLC-D Card

X4	Signal	Spec.	X4	Signal	Spec.	X4	Signal	Spec.
A1	DP 16	B,TS	B1	DP 17	B,TS	C1	DP 18	B,TS
A2	DP 19	B,TS	B2	DP 20	B,TS	C2	DP 21	B,TS
A3	DP 22	B,TS	B3	DP 23	B,TS	C3	GND	
A4	DP 24	B,TS	B4	DP 25	B,TS	C4	DP 26	B,TS
A5	DP 27	B,TS	B5	DP 28	B,TS	C5	DP 29	B,TS
A6	GND		B6	DP 30	B,TS	C6	DP 31	B,TS
A7	AP 0	B,TS	B7	+5V	UN5	C7	AP 1	B,TS
A8	AP 2	B,TS	B8	AP 3	B,TS	C8	AP 4	B,TS
A9	AP 5	B,TS	B9	GND		C9	AP 6	B,TS
A10	AP 7	B,TS	B10	AP 8	B,TS	C10	AP 9	B,TS
A11	AP 10	B,TS	B11	AP 11	B,TS	C11	AP 12	B,TS
A12	+5V		B12	/R-WN	I,T	C12	/RES	I,T
A13	/EBUSINT	O,OC	B13	/DSACK1	O,OC	C13	GND	
A14	/DSACK0	O,OC	B14	/DS	I,T	C14	/AS	I,T
A15	SIZ0	I,BT	B15	SIZ1	I,BT	C15	/EBUS	I,T
A16	PCLOCKP	I,T	B16	CON-CYC	I,T	C16	+5V	UN5

Table C-12: Connector configuration X4, interface to CLC

Explanations:

I = input
O = output
B = bi-directional
OC = open collector
TS = tristate
UN = rated voltage +5V

Signal Configuration X5 Connector on CLC-D Card

X5	Signal	Spec.	X5	Signal	Spec.	X5	Signal	Spec.
A1			B1			C1		
A2			B2			C2		
A3			B3			C3		
A4			B4			C4		
A5			B5			C5		
A6			B6			C6		
A7			B7			C7		
A8			B8			C8		
A9			B9			C9		
A10			B10			C10		
A11			B11			C11		
A12			B12			C12		
A13			B13			C13		
A14			B14	+5V		C14	+5V	
A15	GND		B15	GND		C15	GND	
A16			B16	PE		C16		

Table C-13: Connector configuration X5, interface to drive / card rack

DBS03.1 Diagnostics

LED Diagnostics on the Front Panel

The DBS03.1 panel has a total of 8 diagnostic LEDs on the front. These enable the diagnostic states between the InterBus-S ring and communications between the DBS03.1 board and the CLC-D.

Arrangement of the Diagnostics -LED

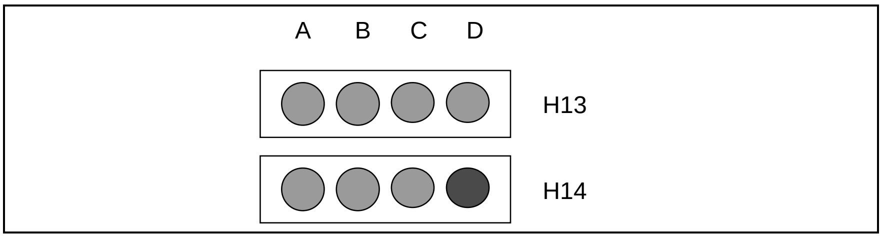


Figure C-3: LED diagnostic arrangement

LED Diagnostic Definitions

- H13A (green) **UL**
  Power source of INTERBUS-S - drive OK
  The power source comes from the 5V of DBS03.1 board via the DC/DC converter and made available to the galvanically isolated bus drivers.
- H13B (green) **BA** Bus active
  INTERBUS-S Process data transmission active
  This LED is always on if the master has activated his cyclical data traffic on the BUS.
- H13C (green) **TR** Transmission active
  If PCP communications are supported on the INTERBUS-S ring with this participant, then this LED is activated. PCP initialization and object structure reading are also evaluated as PCP communications (Get.OV).
- H13D (green) **RC** Remote Check
  This LED checks bus in the ring leading from this participant to the next. If this path is OK, then the LED is switched on. The LED is set with the initialization of the INTERBUS-S ring if detected that it is OK.
- H14A (green) **SW-RUN** Software-RUN
  This LED is used with the LED H14C. It support the diagnostic of the correct software RUN and displays the successful synchronization between CLC-D and DBS03.1. LED H14A and H14C simultaneously specify via their flash frequency the current SERCOS cycle time.
  If synchronization between CLC-D and DBS03.1 is corrected, then these LEDs flash alternately. A rhythmic flashing indicates a working INTERBUS-S interface but a faulty synchronization of the CLC.
- H14B (green) **+24 V** external +24V applied
  This LED is only used with DBS 4.2 board.
- H14C (green) **SW-RUN** software RUN
  See description on LED H2A.

H14D (red) **RD** Remote-Bus disable
This LED is on if the relaying bus is not working. Whether a relaying bus is mounted or not is detected by that board with the RBST signal which is connected to +5V via a relaying bridge. If a relaying cable is mounted, but the connection to the next participant has broken down, then this LED is switched on if the master runs his bus check.

D Drawings

CTA10-1 dimensional drawing

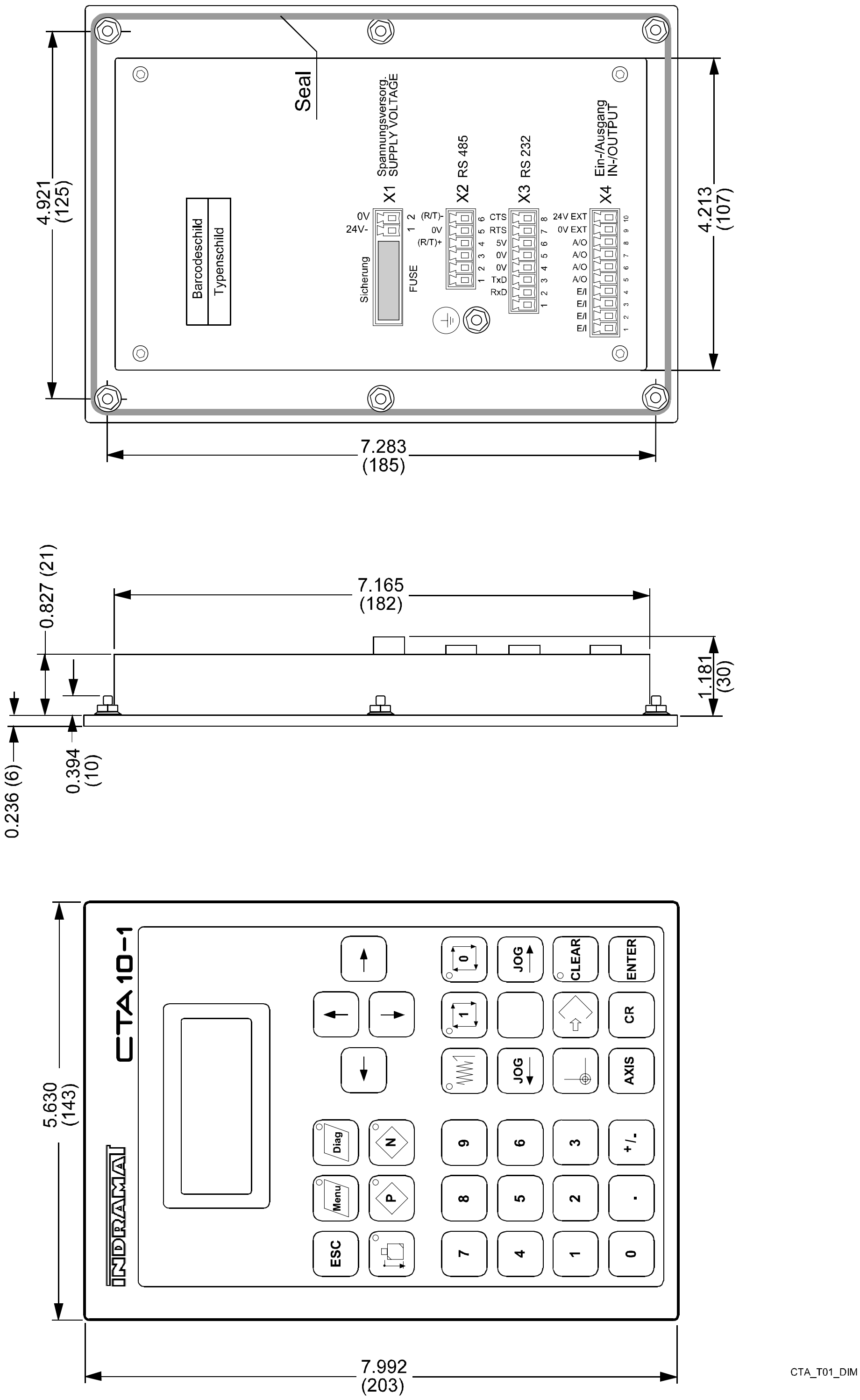


Figure D-1: Dimensional drawing of CTA10-1

Connection diagram for CLC-D02.xM-FW

The CLC-D control card is the hardware platform in which the TRANS 01-D firmware resides in the form of two EPROM chips.

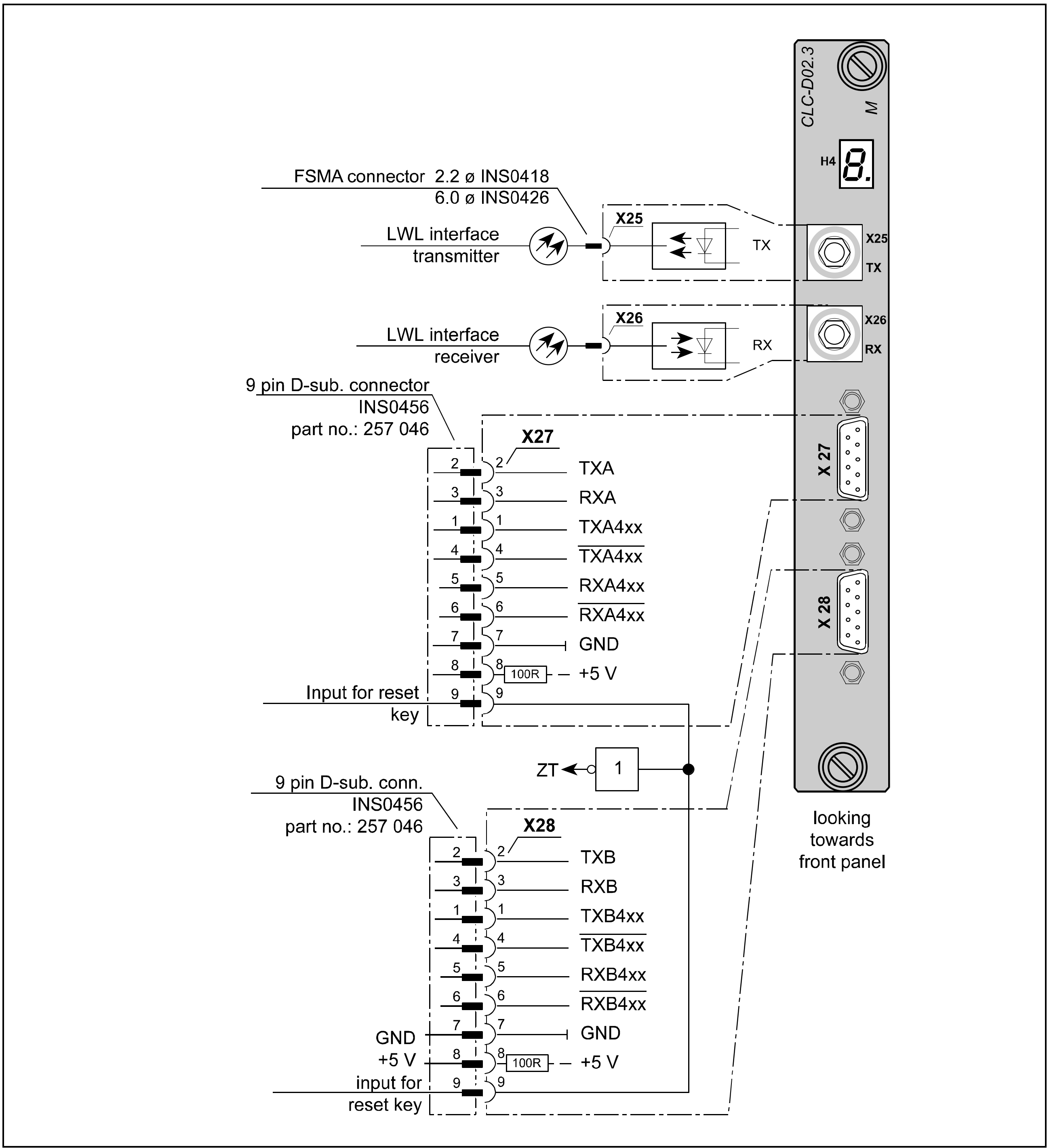
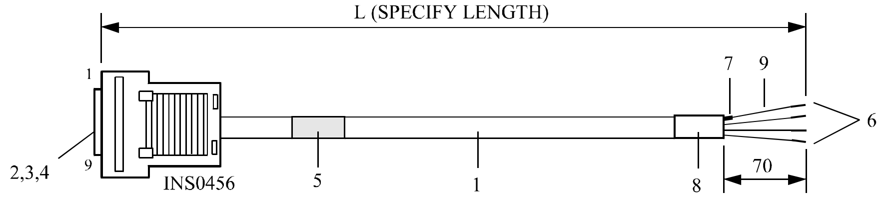
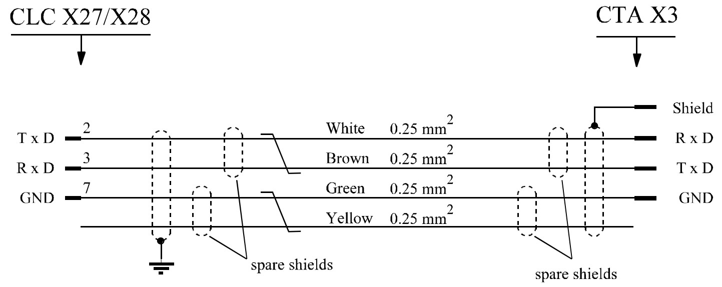


Figure D-2: Connection diagram - CLC-D02.3M-FW

CLC to CTA serial communication cable - IKS0149





Shield is grounded to connector housing by means of metallic insert.

max. Cable length 15 m

Insulate soldered connections with heat shrink tubing (Item No. 7).
Cut unused conductors flush with cable outer jacket.

Item	Description	Qty.	Drawing/Type	Part Number	Details
1	Cable	1	INK0233	219 758	L1/ Specify length
2	Connector Receptacle	1	9-pin Male	220 624	INS0456
3	Connector Housing	1		225 424	
4	Screws	2		221 657	
5	Cable Label	1		218 326	
6	Wire End Ferrules	4	Light Blue	237 489	
7	Heat Shrink Tubing	4	1/16" dia.	Vendor	9 mm
8	Heat ShrinkTubing	1	3/8" dia.	Vendor	30 mm
9	Clear Conductor	1	$0.25\ mm^2$	238 514	70 mm
10					
11					
12					
13					

1995	Date	Name	X	Date	Name	E.C.O.	ENT3A-IKS 149	Part No. 267 280
Drawn	22.01						Page 1	Description IKS0149
Appvd.								
Norm							of 1	Drawing Number: 209 - 0050 - 4801 - 00 / 149.0
INDRAMAT			Rev. for				Per E.C.O.	Repd. By: Per E.C.O.

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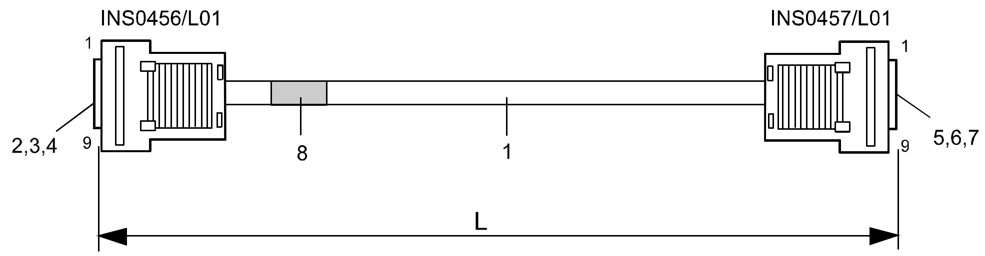
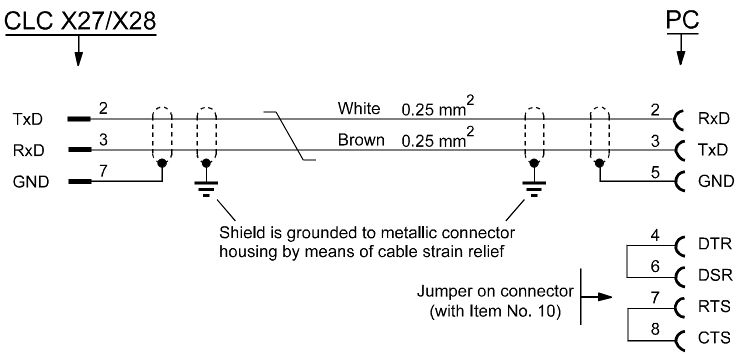
Figure D-3: IKS0149 serial communication cable

CLC to PC serial communication cable - IKS0061





max. Length 15 m!

A contact between inner and outer shields must not occur!
Insulate soldered connections with heat shrink tubing (Item No. 9).

Item	Description	Qty.	Drawing/Type	Part Number	Details
1	Cable	1	INK0572	270 233	
2	Connector Housing	1		255 424	INS0456/L01
3	Connector Receptacle	1	9-pin Male	220 624	
4	Screws	2		221 657	
5	Connector Housing	1		255 424	INS0457/L01
6	Connector Receptacle	1	9-pin Female	222 740	
7	Screws	2		221 657	
8	Cable Label	1		218 326	
9	Heat Shrink Tubing	10	1/16" dia.	Vendor	9 mm
10	Black Conductor	1	0.25 mm^2	213 411	40 mm
11					
12					
13					

1993	Date	Name	X	Date	Name	E.C.O..	ECM4-3A - IKS0061	Part No. 256 006
Drawn	16.11.	Kr.	a	03.05.94	HÜTTL	3477	Page 1	Description **IKS0061**
Appvd.			03	11.05.98	Krautwald	5507		
Norm							of 1	Drawing Number: **209 - 0050 - 4801 - 03 / 0061**
Indramat			Rev. for 209-0050-4801-00/061.1				Per E.C.O.5507	Repd. By: / Per E.C.O.

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Figure D-4: IKS0061 serial communication cable

Connection diagram for DEA28.1M

Note that either IKS0159 or IKS0186 can be used. IKS0159 has been replaced by IKS0186. They have the same connections and color code. They differ only in construction of the cable jacket material.

Note also that the signal names on this drawing refer to firmware version 06VRS only. New function signals added in 07VRS are not shown on this drawing.

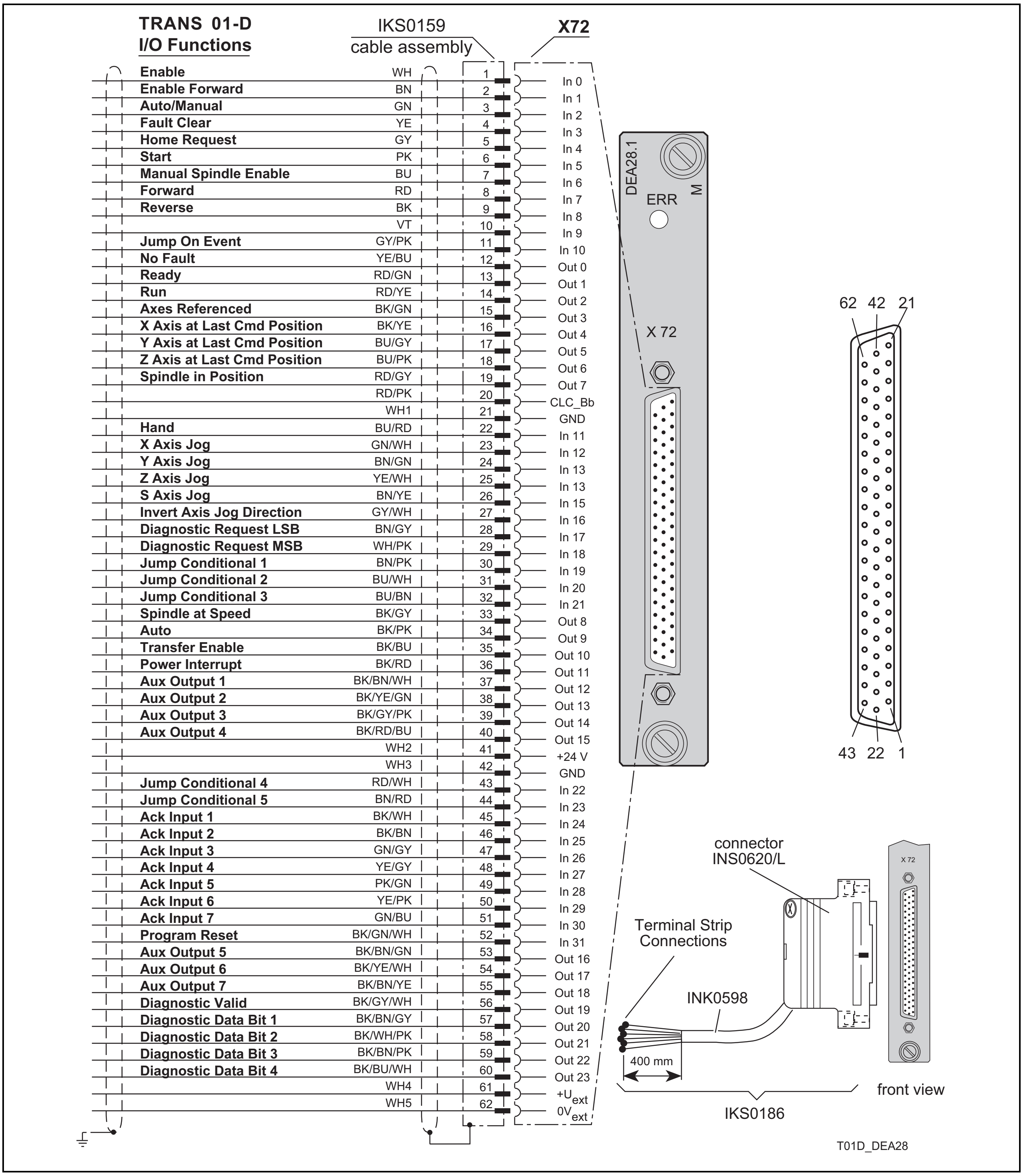

Figure D-5: Connection diagram - DEA28.1M

DEA28.1M I/O cable - IKS0186

Note that either IKS0159 or IKS0186 can be used. IKS0159 has been replaced by IKS0186. They have the same connections and color code. They differ only in construction of the cable jacket material.

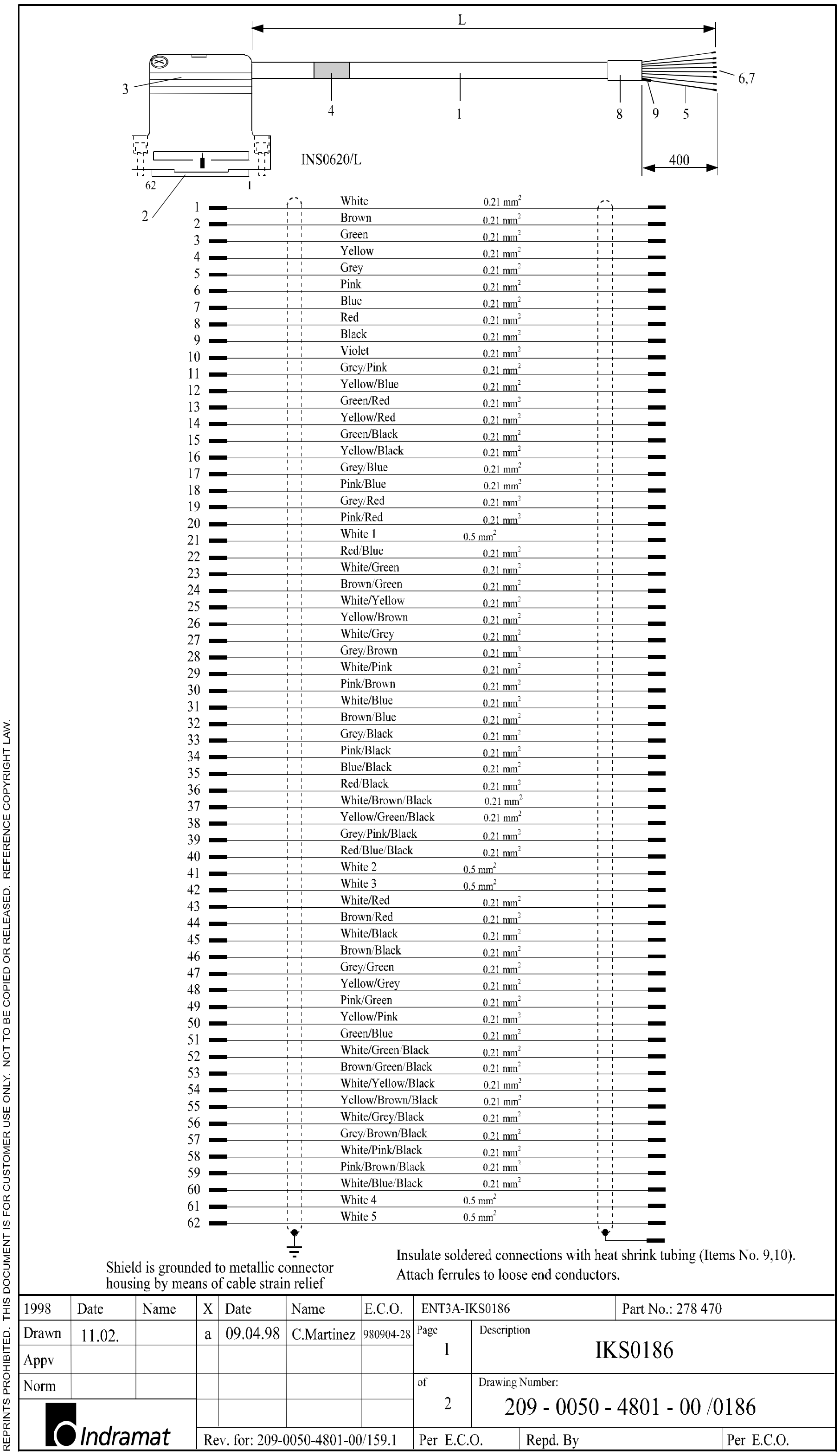

Figure D-6: IKS0186 I/O cable

DEA28.1M I/O cable - IKS0159

Note that either IKS0159 or IKS0186 can be used. IKS0159 has been replaced by IKS0186. They have the same connections and color code. They differ only in construction of the cable jacket material.

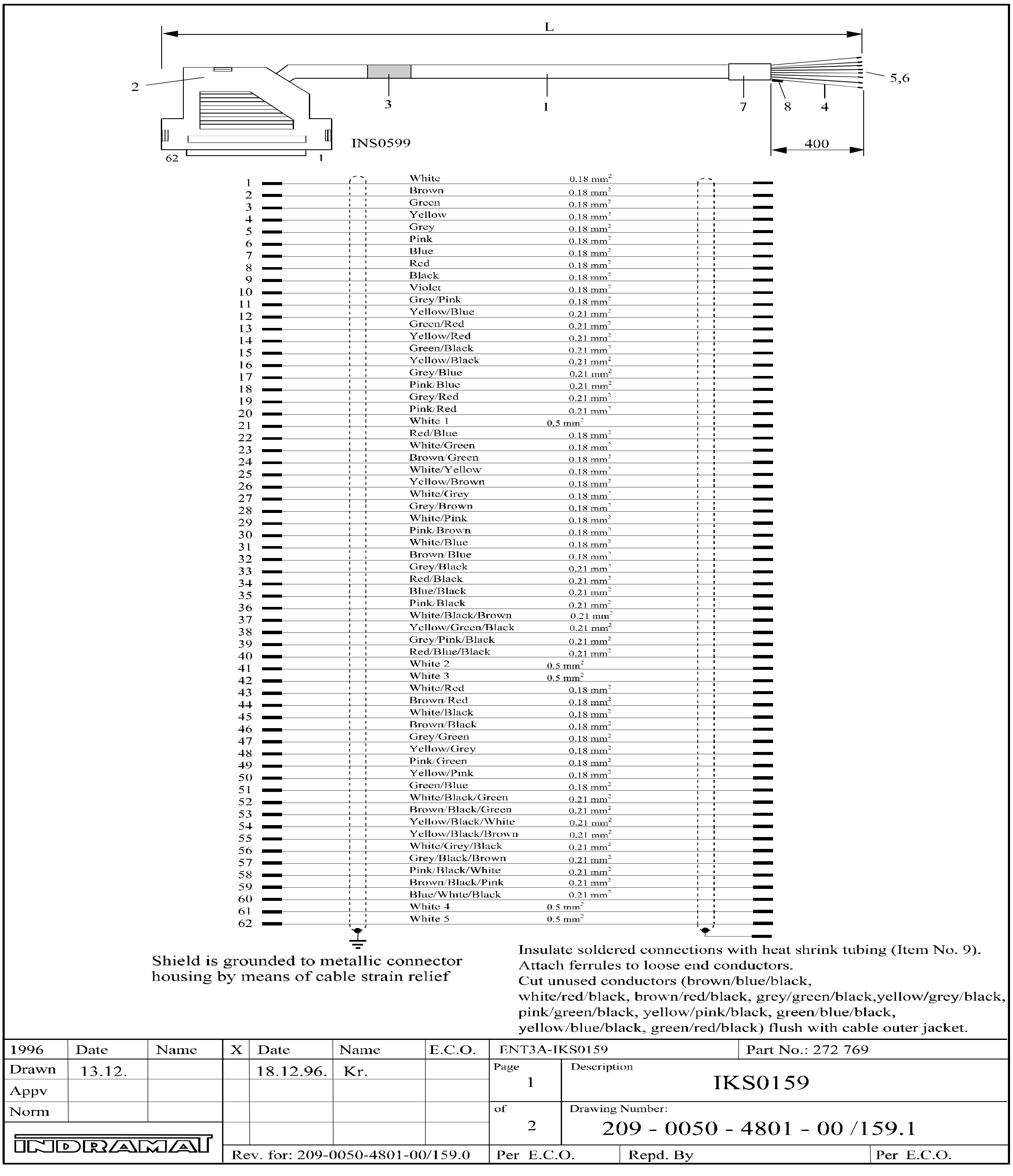

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Figure D-7: IKS0159 I/O cable

Connection diagram for DEA04.x I/O

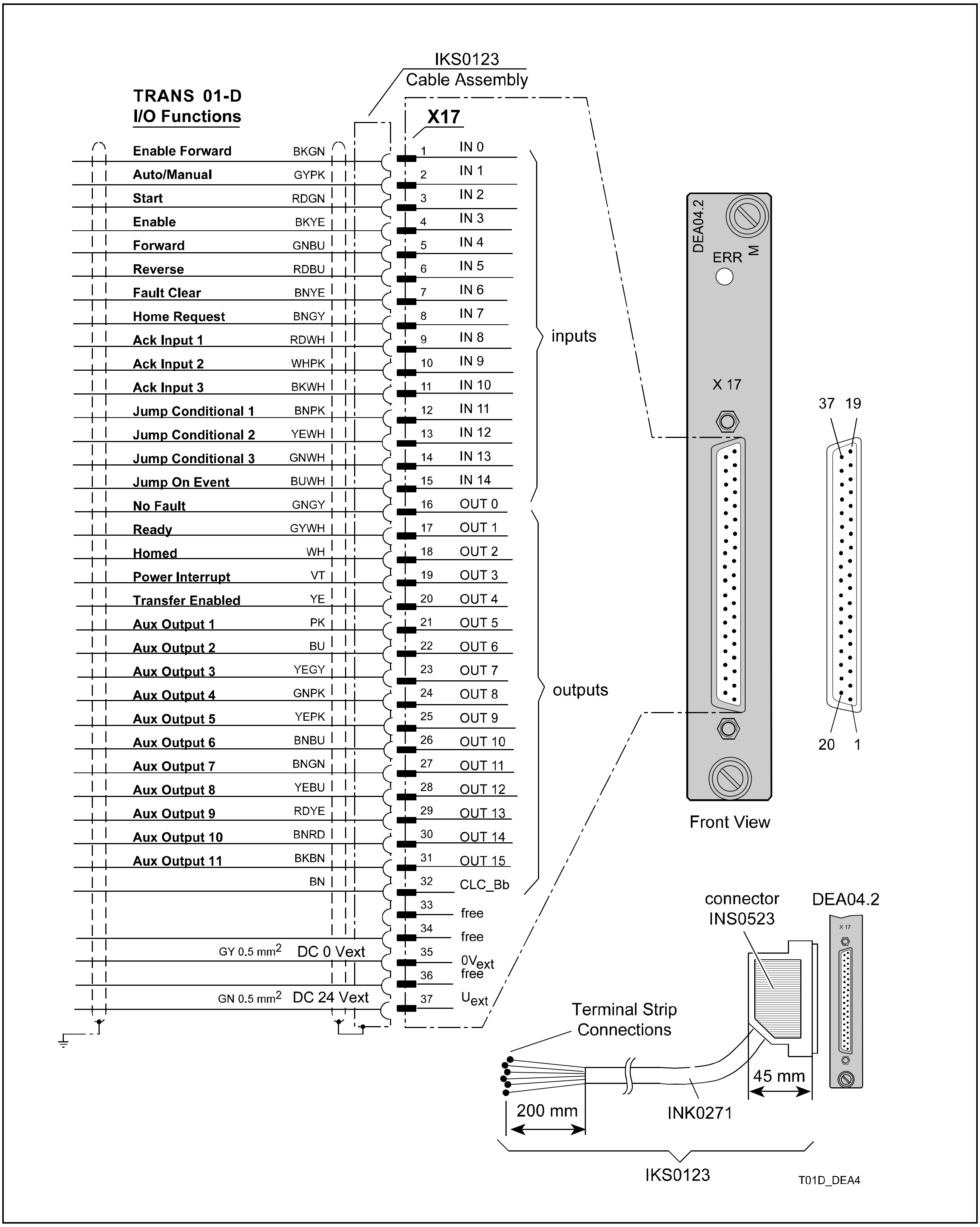

Figure D-8: Connection diagram - DEA04.x

Connection diagram for DEA05.x I/O card

Note that the signal names on this drawing refer to firmware version 06VRS only. The mapping of some signals was changed from version 05VRS to version 06VRS. New function signals added in 07VRS are not shown on this drawing.

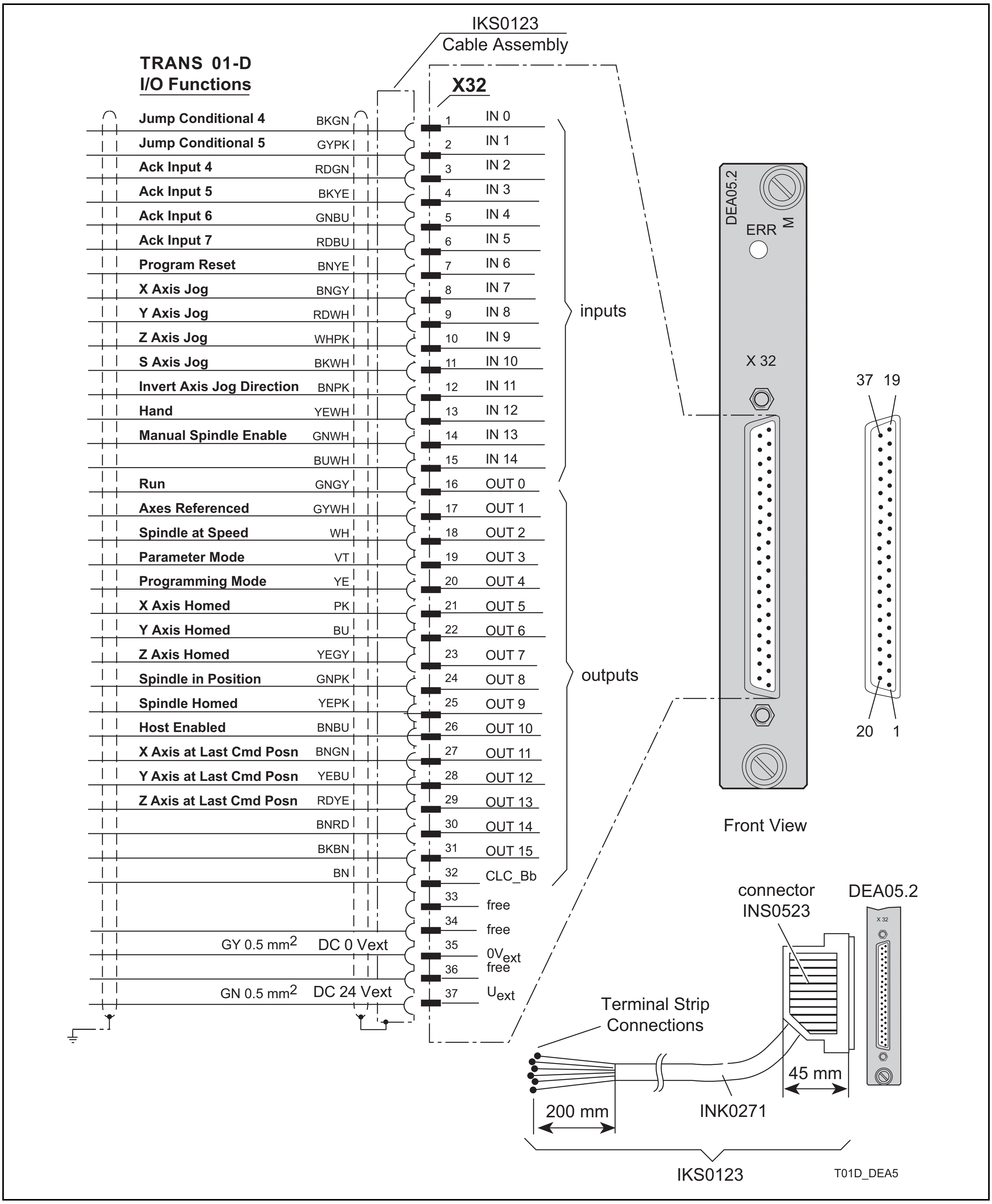

Figure D-9: Connection diagram - DEA05.x

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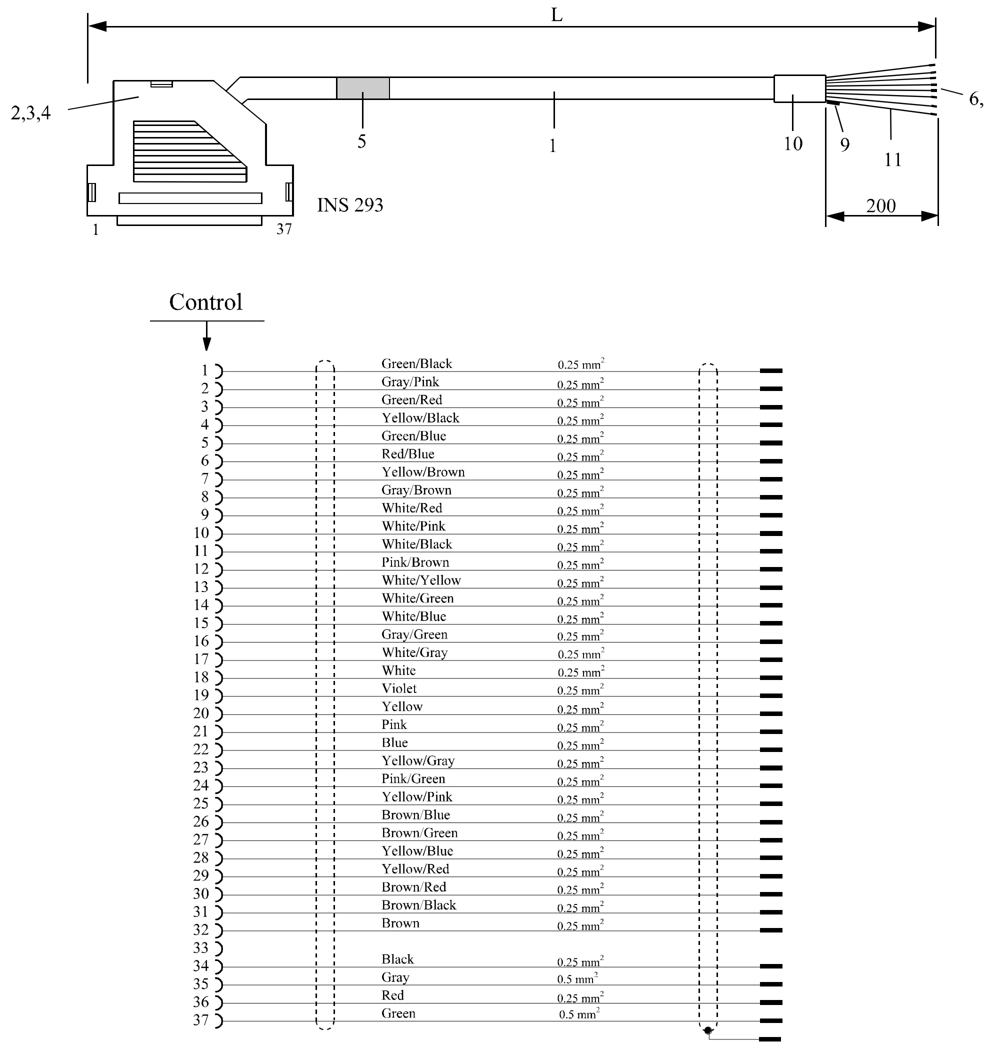
DEA4.x and DEA5.x I/O cable - IKS0123



Insulate soldered connections with heat shrink tubing (Item No. 10).

Item	Description	Qty.	Drawing/Type	Part Number	Details
1	Cable	1	INK 271	226 148	L1/ Specify length
2	Connector Receptacle	1	37-pin Female	221 652	INS 293
3	Connector Housing	1		221 659	
4	Screws	2		221 657	
5	Cable Label	1		218 326	
6	Wire End Ferrules	34	Light Blue	237 489	
7	Wire End Ferrules	3	Orange	217 156	
8	Heat Shrink Tubing	36	1/16" dia.	Vendor	9 mm
9	Heat Shrink Tubing	1	3/32" dia.	Vendor	9 mm
10	Heat Shrink Tubing	1	1/2" dia.	Vendor	30 mm
11	Clear Conductor	1	0.5mm²	239 974	200 mm

1992	Date	Name	X	Date	Name	E.C.O.	ENT3A	Part No.: 262 974
Drawn	09.09.						Page 1	Description: IKS 123
Appv								
Norm							of 1	Drawing Number: 209 - 0050 - 4801 - 00 / 123.0
INDRAMAT			Rev. for				Per E.C.O.	Repd. By / Per E.C.O.

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Figure D-10: IKS0123 I/O cable

Connection diagram for DLF01.1M

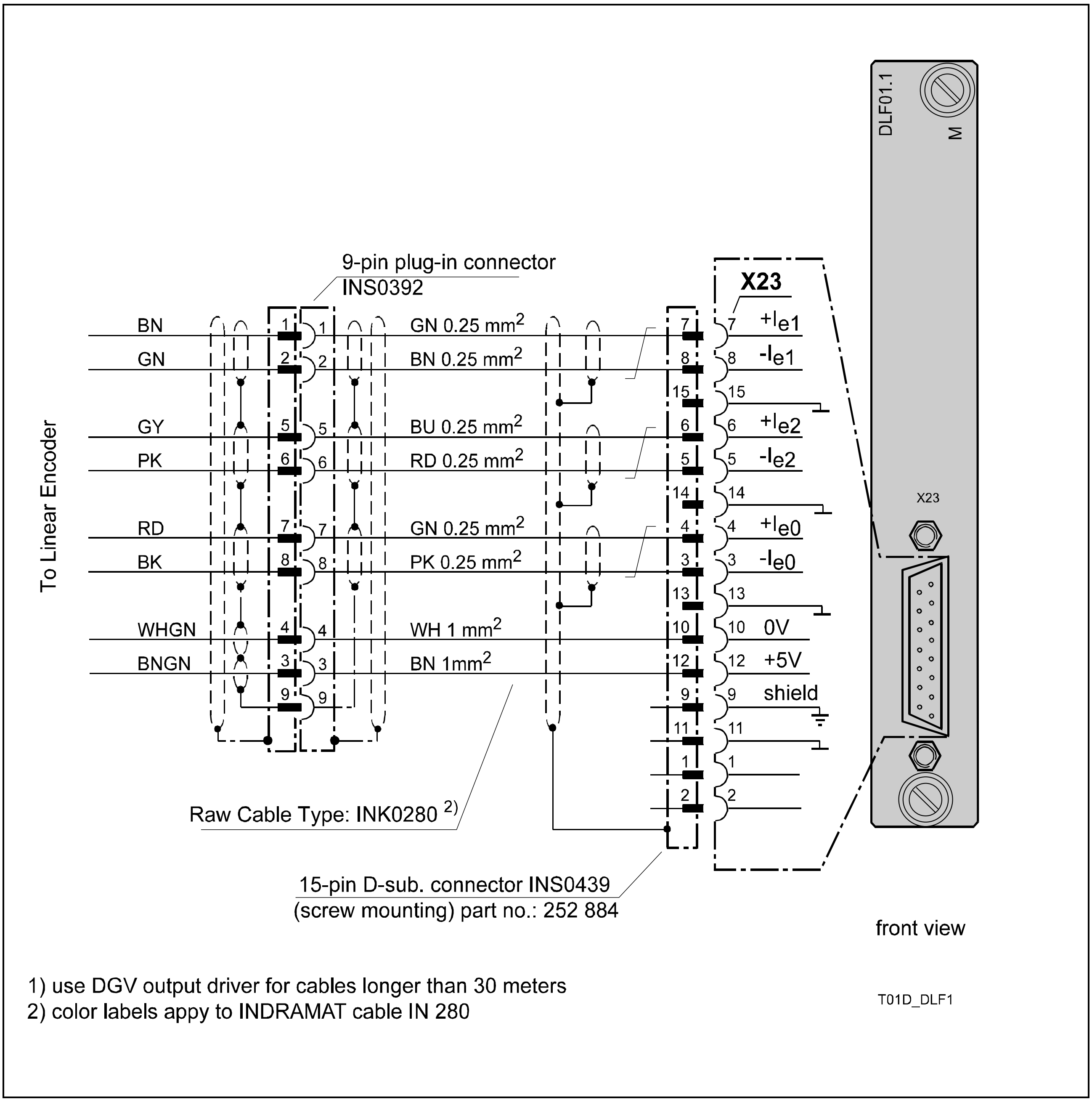
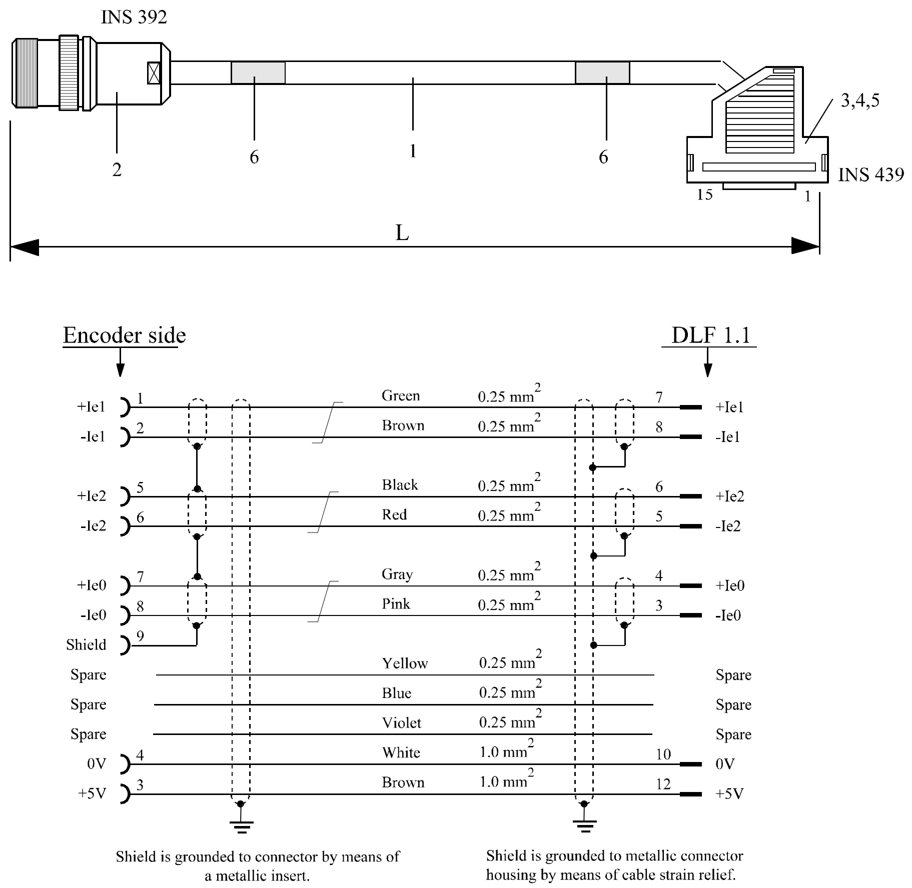


Figure D-11: Connection diagram - DLF01.1M

DLF01.1M high resolution encoder cable - IKS0349



Reinforce shield drain wire with heat shrink tubing (Item No. 8,9).
Insulate soldered connections with heat shrink tubing (Item No. 7).
Cut unused conductors flush with cable outer jacket.
*Items must be purchased from Indramat.

Item	Description	Qty.	Drawing/Type	Part Number	Details
1	* Cable	1	INK 280	227 266	
2	Coupling Connector	1		248 635	INS 392
3	Connector Housing	1		252 881	INS 439
4	Screws	2		221 657	INS 439
5	Connector Receptacle	1	15-pin Male	220 623	INS 439
6	Cable Label	2		218 326	
7	Heat Shrink Tubing	16	1/16" dia.	Vendor	9 mm
8	Heat Shrink Tubing	4	1/16" dia.	Vendor	20 mm
9	Heat Shrink Tubing	4	3/32" dia.	Vendor	9 mm
10					
11					
12					
13					

1992	Date	Name	X	Date	Name	E.C.O.	ENT3A-IKS 349	Part No.: 249 908
Drawn	26.08.		02	21.11.94			Page 1	Description: IKS 349
Appvd.								
Norm							of 1	Drawing Number:: 209 - 0050 - 4801 - 00 / 349.2
INDRAMAT			Rev. for 209-0050-4801-00/349.1				Per E.C.O.	Repd. By / Per E.C.O.

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Figure D-12: IKS0349 high resolution encoder cable

MT25W external linear encoder diagram

The stroke of the MT25W is 25mm (0.984 inch) as dimensioned in the drawing below (74mm face to released tip – 49mm face to depressed tip).

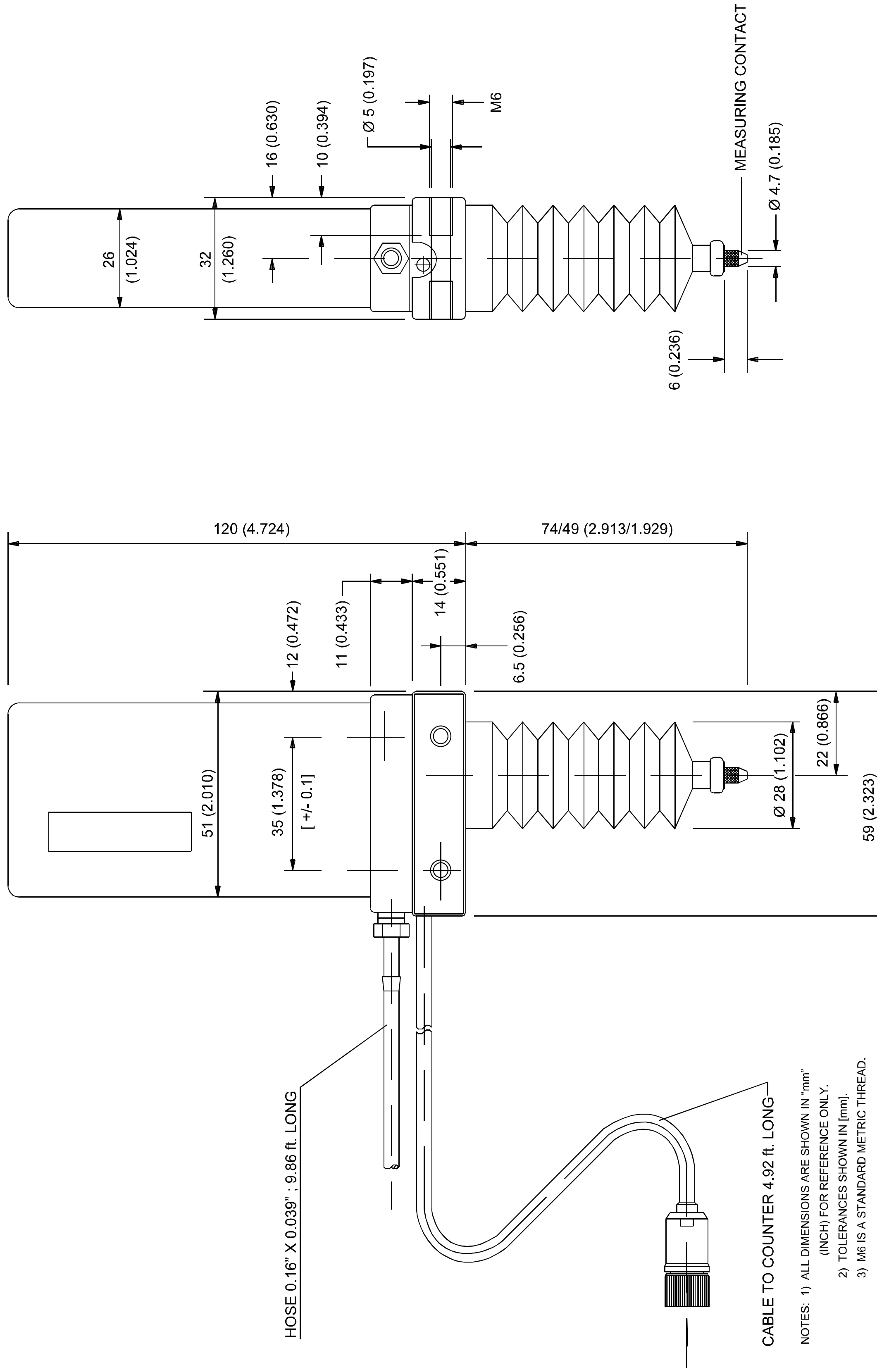

Figure D-13: MT25W external encoder

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Connection diagram for DSS01.3

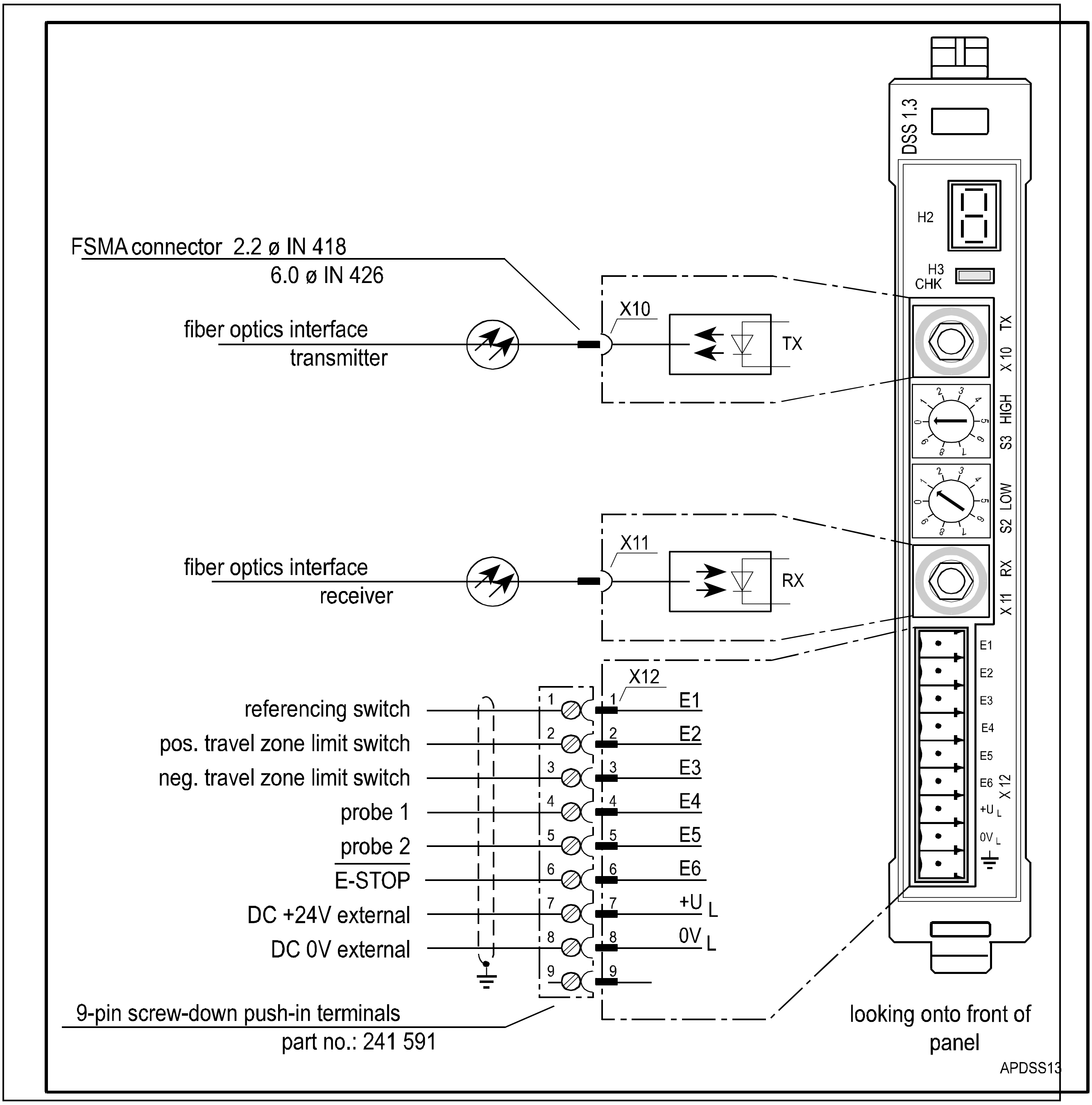

Figure D-14: Connection diagram - DSS01.3

Connection diagram for DSS02.1M

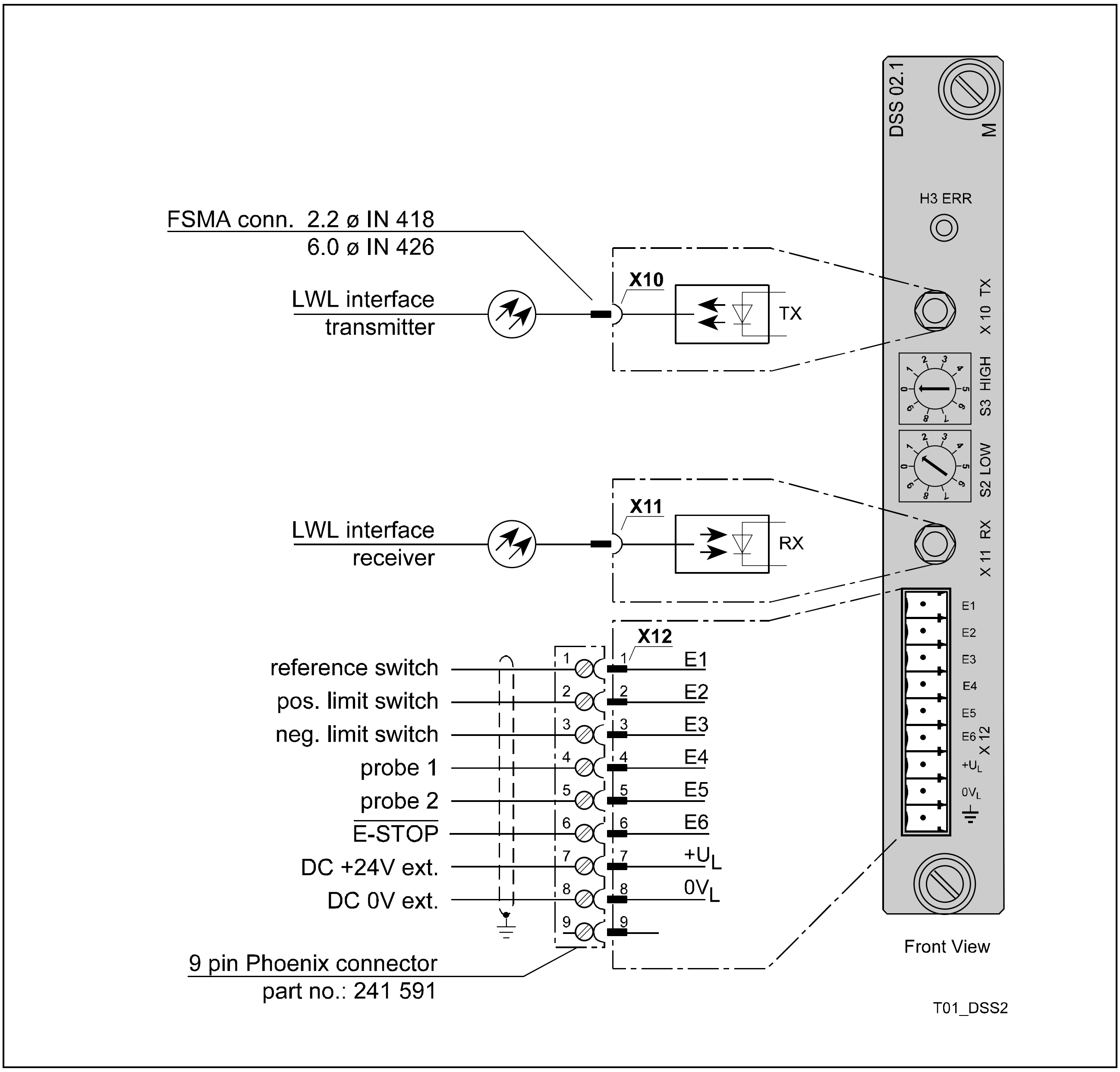

Figure D-15: Connection diagram - DSS02.1M

Interconnection diagram for CLC-D/TVD/DDS/MDD - Sht. 1 of 4

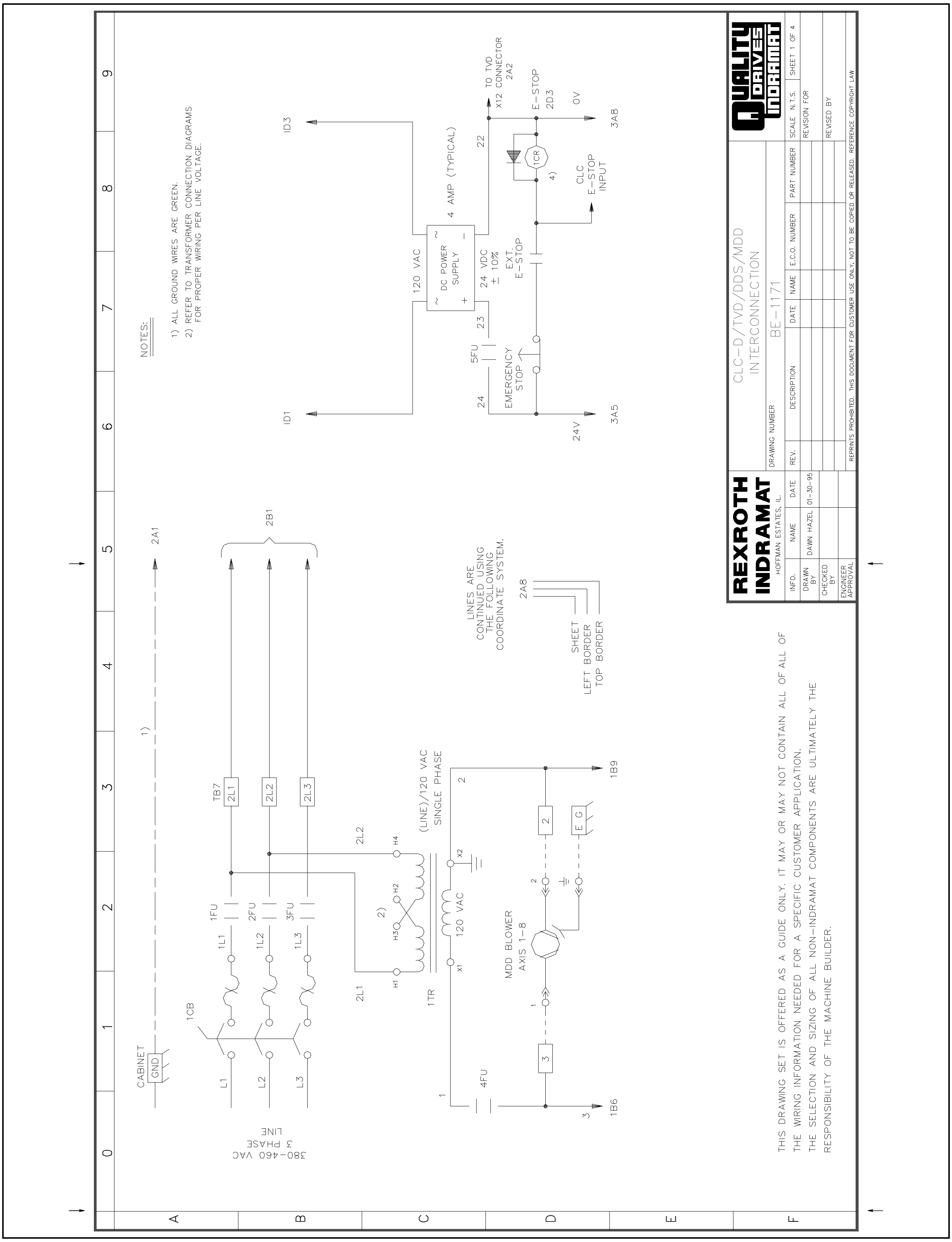

Figure D-16: CLC-D/TVD/DDS/MDD Interconnection Diagram, Sheet 1 of 4

Interconnection diagram for CLC-D/TVD/DDS/MDD - Sht. 2 of 4

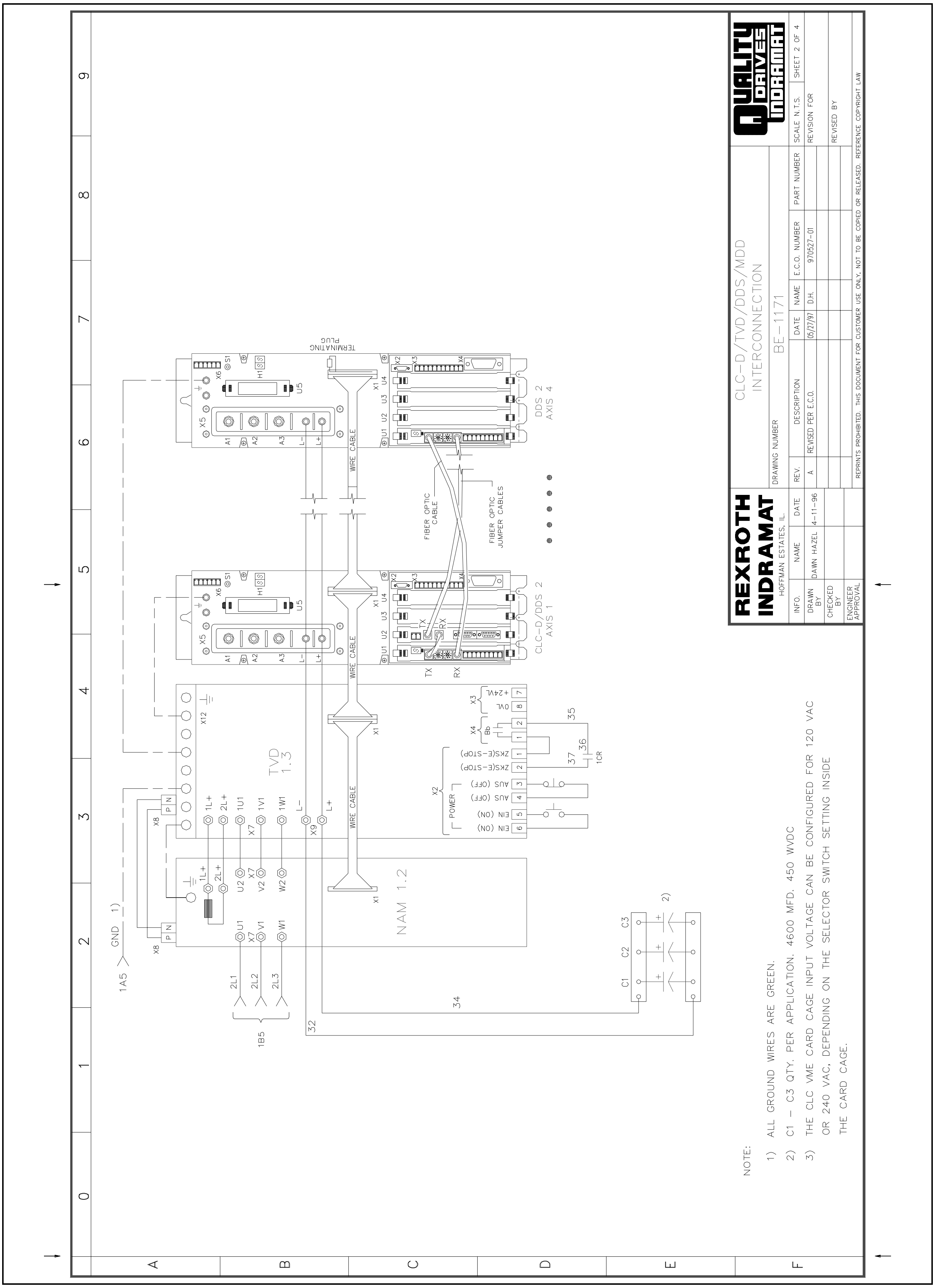

Figure D-17: CLC-D/TVD/DDS/MDD Interconnection Diagram, Sheet 2 of 4

Interconnection diagram for CLC-D/TVD/DDS/MDD - Sht. 3 of 4

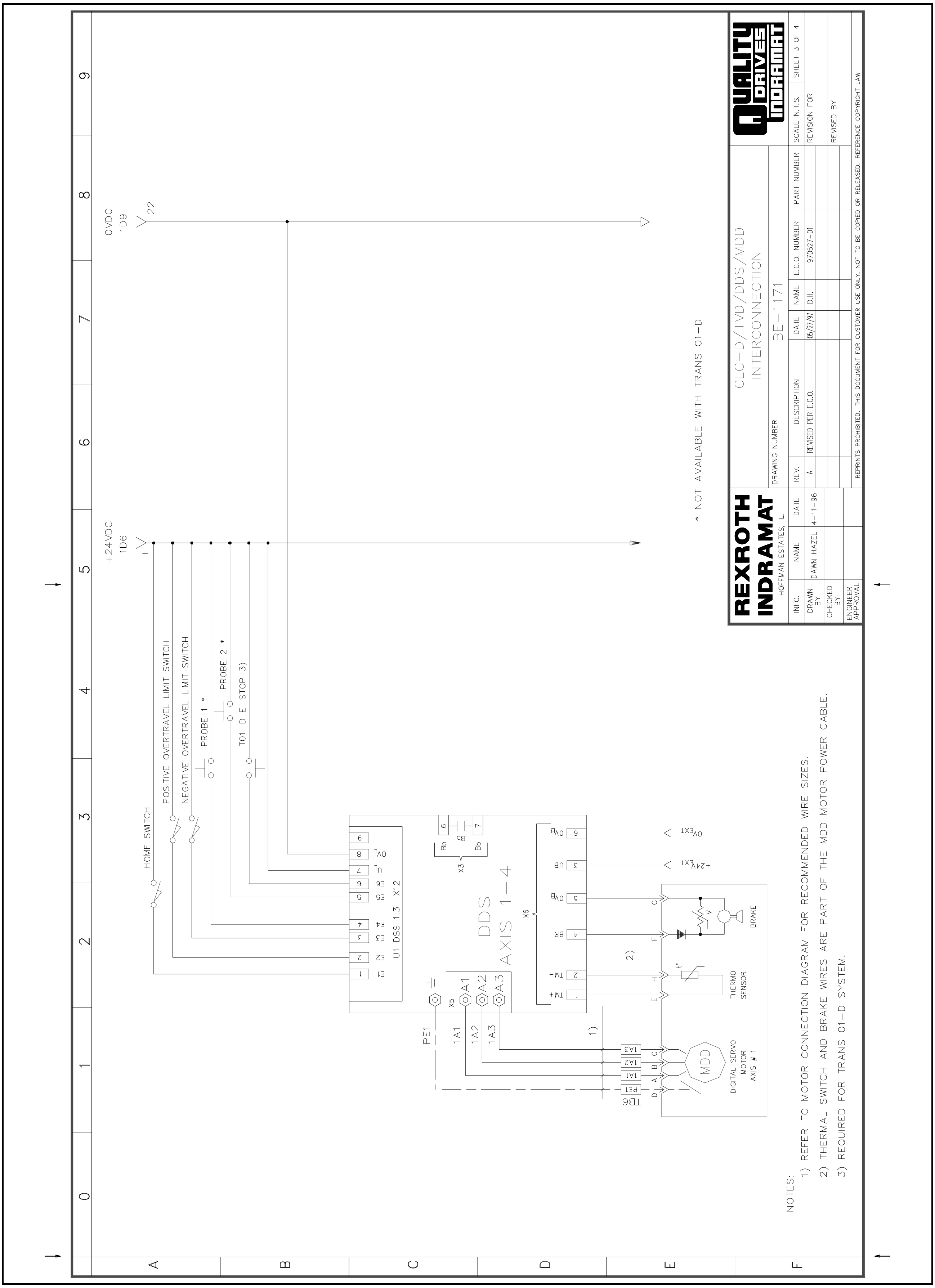

Figure D-18: CLC-D/TVD/DDS/MDD Interconnection Diagram, Sheet 3 of 4

Interconnection diagram for CLC-D/TVD/DDS/MDD - Sht. 4 of 4

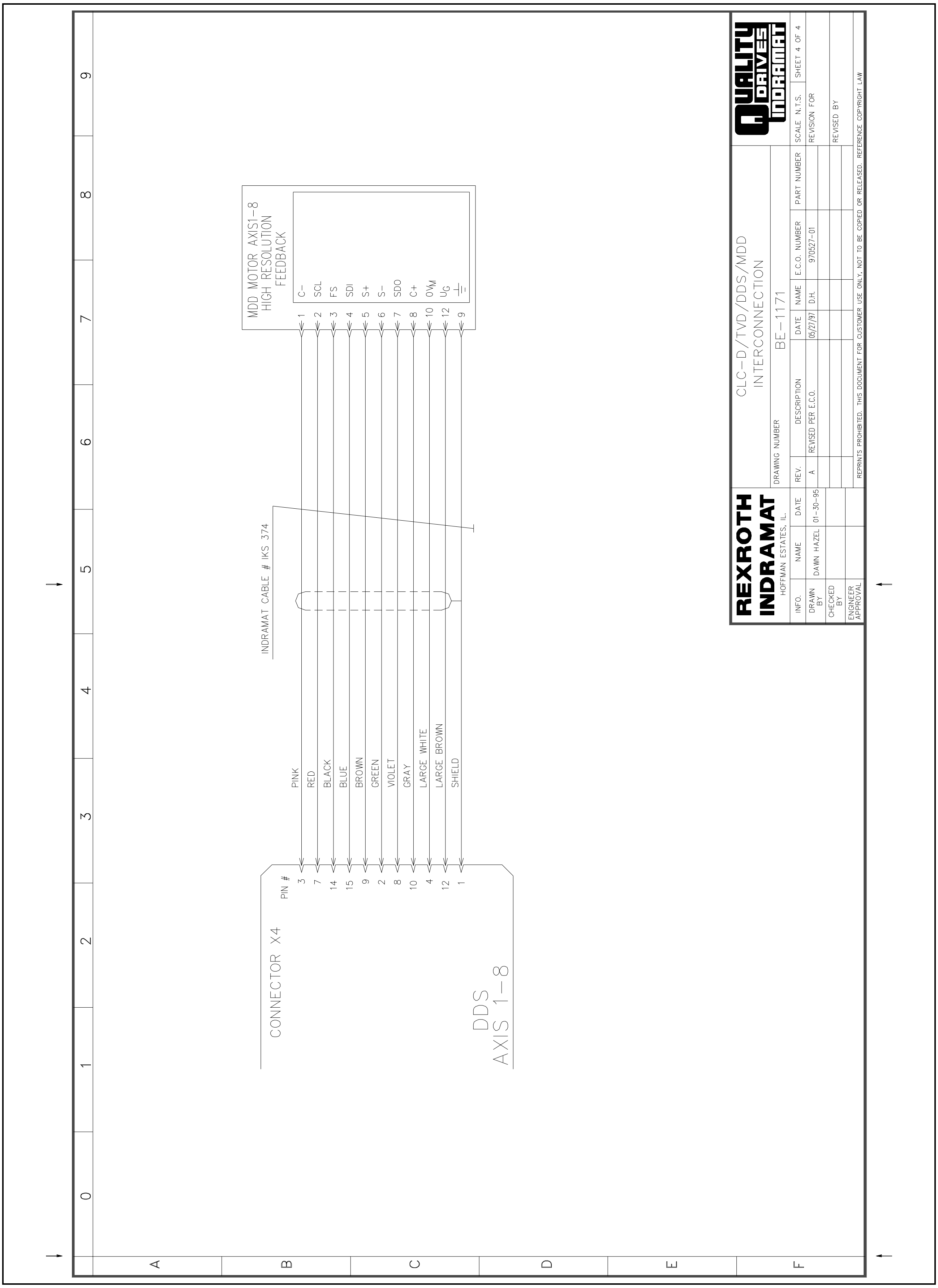

Figure D-19: CLC-D/TVD/DDS/MDD Interconnection Diagram, Sheet 4 of 4

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